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Department of
Agriculture
Forest Service

Pacific Southwest Region

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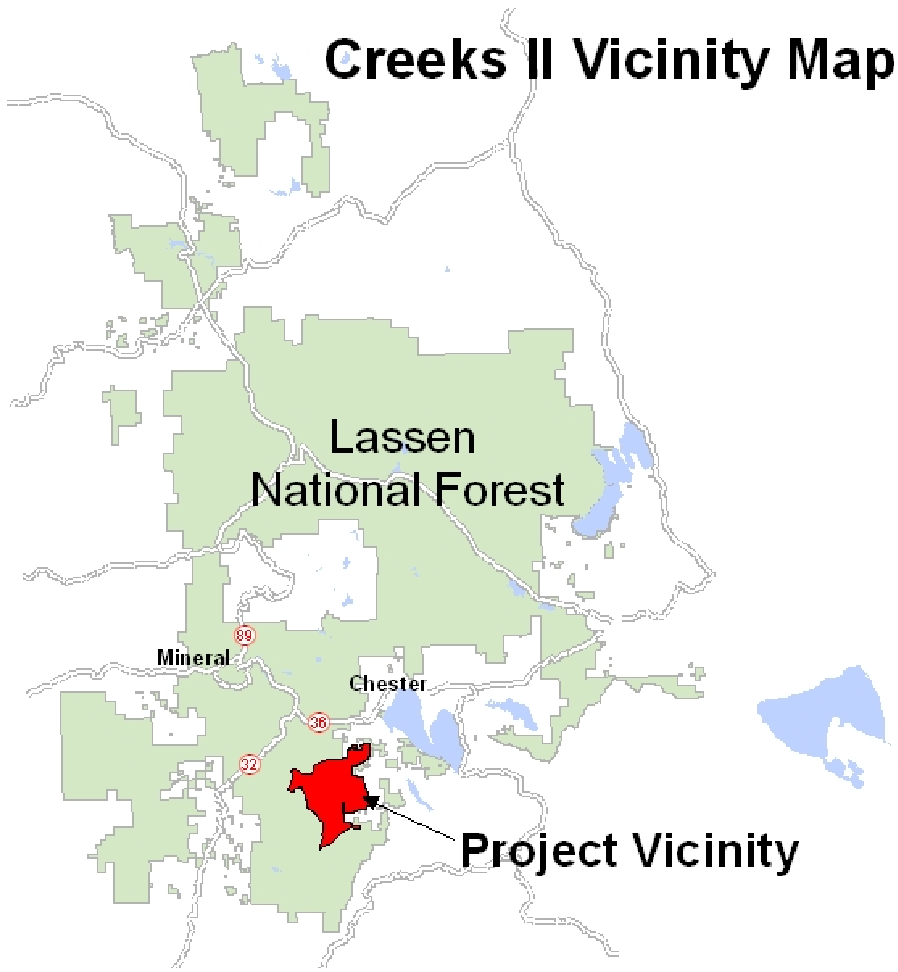
Draft Environmental Impact Statement

Creeks II Project

Almanor Ranger District, Lassen National Forest
Plumas County, California



List of Acronyms

AQMD	Air Quality Management District
BA	Biological assessment
BE	Biological evaluation
BMP	Best Management Practices
CAAQ	California Ambient Air Quality
CARB	California Air Resources Board
CBH	Crown base height
CCF	Hundred cubic feet
CDFA	California Department of Food and Agriculture
CDWR	California Department of Water Resources
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRWQCB	California Regional Water Quality Control Boards
CWE	Cumulative watershed effects
CWHR	California wildlife habitat relationships
CWPP	Community Wildfire Protection Plan
d.b.h.	Diameter at breast height
DEIS	Draft environmental impact statement
DFCN	Draft forest carnivore network
DFPZ	Defensible Fuel Profile Zone
EHR	Erosion Hazard Rating
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
ERA	Equivalent roaded acres
ESA	Endangered Species Act
FEIS	Final environmental impact statement
FM	Fuel model
FMA	Fire Management Analyst
FSEIS	Final supplemental environmental impact statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
FVS FFE	Forest Vegetation Simulator, Fire and Fuels Extension
GIS	Geographic Information System
HFQLG Act	Herger-Feinstein Quincy Library Group Forest Recovery Act
HFRA	Healthy Forest Restoration Act
HRCA	Home Range Core Area
HUC	Hydrologic Unit Code
ID Team	Interdisciplinary Team
KV	Knutson-Vandenburg
LOP	Limited operating period

LRMP	Land and Resource Management Plan
LVNP	Lassen Volcanic National Park
MIS	Management Indicator Species
ML	maintenance level
mmbf	Million board feet
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NTMB	Neotropical migratory birds
NWCG	National Wildlife Coordination Group
OHV	Off-highway vehicle
PAC	Protected Activity Center
PC FSC	Plumas County Fire Safe Council
PFA	Post-fledging area
PM	Particulate matter
PNF	Plumas National Forest
PSW	Pacific Southwest Research Station
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objective
ROD	Record of Decision
ROS	Recreational Opportunity Spectrum
SAT	Scientific Analysis Team
SDI	Stand density index
SMZ	Stream Management Zone
SNFPA	Sierra Nevada Forest Plan Amendment
SOHA	Spotted Owl Habitat Area
TES	Threatened, endangered and sensitive species
TOC	Threshold of Concern
USDA	U. S. Department of Agriculture
VQO	Visual Quality Objective
WEPP	Watershed Erosion Prediction Project
WUI	Wildland-urban Interface

Creeks II project

DRAFT

Environmental Impact Statement

Plumas County, California

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Abstract: The United States Department of Agriculture, U.S. Forest Service, Lassen National Forest, Almanor Ranger District proposes to protect rural communities from fire hazards by constructing fuel breaks known as Defensible Fuel Profile Zones (DFPZs); implementing group selection harvest methods to create a fire-resilient healthy forest ecosystem; implementing area thinning to restore stand densities more characteristic of past natural fire regimes and performing associated road system improvement work on approximately 8060 acres of forested federal land near Chester, California. This DEIS discloses the direct, indirect, and cumulative environmental effects that would result from the proposed action and alternatives. Three action alternatives and the no-action alternative are analyzed in this document. alternative 3 is the preferred alternative.

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 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, are 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.

Send Comments to: **Almanor Ranger District- Attn: Creeks II Project**

P.O. Box 767
Chester, CA 96020

Date Comments Must Be Received: This date is estimated based on anticipated publish date of the Notice of Availability in the Federal Register on November 25, 2011. Comment period will end 45 days from the actual date of publication.

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Summary

Introduction

The United States Department of Agriculture, U.S. Forest Service, Lassen National Forest, Almanor Ranger District proposes to protect rural communities from fire hazards by constructing fuel breaks known as Defensible Fuel Profile Zones (DFPZs); implementing group selection harvest methods to create a fire-resilient healthy forest ecosystem; implementing area thinning to restore stand densities more characteristic of past natural fire regimes and performing associated road system improvement work on approximately 8060 acres of forested federal land near Chester, California.

The project area is located in the Butt Creek Management Area (MA 37) and Soda Ridge Management Area (MA 45) in the Almanor Ranger District of the Lassen National Forest. The general location is approximately 12 miles southwest of Chester, California, within Plumas County. The project area encompasses about 33,000 acres and is located in all or portions of: T. 26 N., R. 5 E., sec. 1-4, 10-15, 23-26, 35, 36; T. 26 N., R. 6 E., sec. 1-12, 17-22, 29-31; T. 27 N., R. 5 E., sec. 13-15, 20-29, 32-36; T. 27N., R. 6 E., sec. 2, 3, 9-11, 14-21, 26-35,of the Mount Diablo Meridian. See the vicinity map, Map 1.

Within the project area, conditions fostered by a century of fire suppression, a climate favorable for conifer regeneration and growth, and past management activities including overstory removal have perpetuated dense stand conditions. These dense stand conditions threaten the long-term development and persistence of late-seral habitat. In addition, these dense stand conditions are not favorable for the regeneration of shade intolerant ponderosa pine, Jeffrey pine, and sugar pine (collectively “pine”) and the past removal of large pine trees from the overstory has also contributed to a reduction in the overall pine component. Instead, white fir, a shade tolerant species, has proliferated under the existing conditions and is the species primarily responsible for dense stand conditions in the Creeks II project area. Conifer mortality increases when trees are under stress from a lack of soil moisture, especially after several years of below normal precipitation (Guarin and Taylor 2005). Existing high stand densities place the large tree component of late-seral stands at increased risk of mortality from insects and disease, especially during times of prolonged drought. Dense stand conditions also increase the likelihood that wildfire will move into the forest canopy and result in a high-intensity fire that changes the vegetative character over large areas of forest.

History of project development

A proposal to address fuels and forest health issues within the Creeks Forest Health Recovery Project (Creeks) area of the Lassen National Forest was placed on the Lassen National Forest Schedule of Proposed Actions in February 2004. The project was sent to the public for scoping in 2004 and the Responsible Official, Lassen National Forest Supervisor, signed the Record of Decision (ROD) for Creeks in September 2005. A lawsuit was filed and in August 2006, the Creeks analysis and Decision was remanded to the Forest Service by Judge Damrell, Eastern District Court of California.

The team determined that both the public and the forest lands would be best served by developing a project with a focus on the specific concerns of wildlife habitat and habitat connectivity; taking action to improve overall forest health; and, reducing the risk of large, intense wildfires while providing firefighters with safer areas from which to attack a wildfire. With this change in focus, a new approach to project design and analysis was warranted. On May 30, 2007, the Forest Supervisor agreed to cancel the original Creeks project, rather than create a supplement.

A new purpose and need statement was crafted to address the specific concerns highlighted within the original Creeks project resulting in the Creeks II project that is analyzed within this draft environmental impact statement (DEIS). The Creeks II project boundary encompasses the same project area as the original Creeks analysis, but the focus has changed and the proposed actions have been refined.

Purpose and Need

The Creeks II Project would be managed under the 1992 Lassen National Forest Land and Resource Management Plan (Lassen Forest Plan), as amended by the Herger-Feinstein Quincy Library Group Forest Recovery Act (HFQLG) ROD (USDA Forest Service 1999, 2003), and the Sierra Nevada Forest Plan Amendment ROD (USDA Forest Service 2004) and the Management Indicator Amendment (USDA Forest Service 2007).

Need

Current vegetative conditions in the Creeks II project area reflect the consequences of past management practices described above and are characterized by dense forest stands and heavy fuel loads (surface and ladder). Current conditions within the project area are substantially different from historical times and have increased risks from wildfire, insect and disease, and drought-related mortality. Stands are much denser than they were before fire suppression and other management activities. When conifer communities become too dense, desired attributes such as shrubs and forbs disappear (North et al. 2005) and the risk of mortality due to insects and disease increases. High stand densities also increase the potential for a large, intense wildland fire. Current direction under the Lassen Forest Plan, as amended, provides a direction to undertake activities to improve forest health (mortality due to insect and disease), retain habitat for late seral species, increase stand and landscape heterogeneity, and reduce the potential for large, intense, wildfire.

Purpose

The Creeks II project was developed to implement management activities as directed in the HFQLG Act. Specifically, these activities would address long-term forest health, including habitat, by proposing treatments designed to retain or develop stand structures that promote vegetative heterogeneity at both the stand and landscape level. The elements of forest health that are emphasized within Creeks II are sustainability, plant species diversity and structural complexity at both the stand and landscape level, and insect and disease that are endemic (within normal parameters). A primary goal of the Creeks II project is to reduce the loss of the large ponderosa, Jeffrey, and sugar pine component and to encourage pine development where it existed in greater distribution over the landscape. Equally important to developing stands that would attain the late-seral habitat elements over time are efforts to perpetuate late-seral habitat by reducing the overall fire intensity should a wildfire occur (USDI Fish and Wildlife Service 2006, Johnson and Franklin 2007).

Specific objectives include:

- Improve tree vigor, growth, and insect and disease resistance by reducing stand densities and by favoring the retention and development of pine species.
- Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.
- Implement economically efficient treatments to reduce hazardous fuels and contribute to community stability.
- Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.
- Increase heterogeneity and diversity within size class 4 stands.

- Promote the health of aspen stands.
- Implement transportation improvement actions to improve watershed and water quality conditions.
- Improve vegetative conditions within Riparian Habitat Conservation Areas (RHCAs) to meet Riparian Management Objectives.

Proposed Action

Current direction under the Lassen Forest Plan, as amended, provides a direction to undertake activities to improve forest health (mortality due to insect and disease), retain habitat for late seral species, increase stand and landscape heterogeneity, and reduce the potential for large, intense, wildfire.

.The Almanor Ranger District proposes to utilize site-specific treatments to meet those objectives, as well as implement the required HFQLG program of work. The proposed action uses a combination of commercial timber sales, service and stewardship contracts, and Forest Service crews to 1) protect late-seral values and habitat attributes, 2) develop a DFPZ which is part of a larger network, 3) establish group selection harvest units as directed in the 1999 HFQLG ROD, 4) conduct area thinning, and 5) enhance continuity of DFPZ and area thinning by treating portions of RHCAs on National Forest land within the Creeks II project area. Ideally, treatments would reduce the number of entries required to maintain DFPZ effectiveness for 20 years. The proposed action would implement the direction outlined in Table 2 of the SNFPA ROD (2004).

This proposed action alternative was modified after being sent to the public for scoping. The modifications are detailed in Table 3. Throughout the development of the proposed action and the collaborative process, the Interdisciplinary Team (ID Team) worked diligently to ground-truth and refine maps and locations of treatments, as well as search for and correct mapping errors or confusion. As a result, there were changes in the acres proposed to be treated. The modified proposed action reflects these efforts and is the baseline against which any additional alternatives would be measured.

Public Involvement

HFRA projects are not subject to the 36 CFR 215 regulations for notice, comment, and appeal. Instead, HFRA has a pre-decisional objection process. As part of that pre-decision emphasis, there are distinct requirements for collaboration, public involvement, and alternative development. In part, HFRA directs

- Collaboration (HFRA, Section 104(f)) – The Forest Service shall facilitate collaboration when preparing HFRA projects.
- Public Meetings (HFRA, Section 104(e)) – The Forest Service must conduct a public meeting when preparing an HFRA project.
- Alternative Development (HFRA, Section 104(c) and (d)) – The requirements for a range of alternatives analyzed in an EIS developed under HFRA vary based on land description, including whether the project location is within or outside of Wildland-urban Interface (WUI). The Creeks II project includes area outside of WUI, and as such, the required alternatives are:
    - The proposed action,
    - The no-action alternative, and
    - Not more than one additional action alternative if one is proposed during scoping or the collaborative process. If more than one additional alternative is proposed, the Forest Service must select one and provide a written record describing the reason for its selection. Extensive collaboration efforts were used to generate alternative 3.

Scoping

A public meeting was held at the Almanor Ranger District on February 28, 2008, to introduce new projects and involve people interested in collaborating in the development of these projects. This open house format introduced five proposed projects, one of which was the Creeks II project (Creeks II).

A Notice of Intent (NOI) for the Creeks II project was published in the Federal Register on May 19, 2008, and scoping began on May 20, 2008. During the scoping period, District personnel presented the Creeks II project to the Butte County Fire Safe Council at their regularly scheduled meeting (June 4, 2008).

Eleven letters were received during public scoping and reflect the wide range of what were sometimes conflicting comments and concerns. The ID team reviewed the comments and attempted to develop a single alternative that would meet project objectives and the variety of concerns and suggestions brought forth in the comments.

In mid-August, 2008, the ID team met with the Lassen Forest Supervisor, to discuss the scoping comments and to determine if there was another viable alternative to bring into analysis for the Creeks II project. The requirement under HFRA to limit the alternatives brought into detailed analysis made it difficult to respond to all suggestions. The Forest Supervisor made the decision to request that interested parties join in a discussion of the project that would include face-to-face meetings and provide the opportunity work side-by-side to influence the design of any additional alternative to be analyzed.

Collaboration

The invitation to participate in the Creeks II collaboration was extended to all interested parties and began with a letter sent to those who had responded with scoping comments, as well as those who had provided written or verbal comments at the various meetings prior to scoping. The first meeting took place at the Almanor Ranger District on September 29, 2008. Sixteen people were able to attend that meeting which provided the basis for further discussion and produced requests for additional information to further the collaborative efforts.

Though face-to-face meetings through the fall were postponed or cancelled due to weather, conference calls and requests for further information continued. The responses and information were provided to all the participants and interested parties through mail and electronic media.

A second collaborative meeting was held at the Almanor Ranger District in February, 2009, and 18 people (including ID team members) were able to attend. Notes and comments provided as pre-work for this meeting reflected the dialogue that continued through the fall and acknowledged the changes that were proposed for project in response to the collaborative efforts. This dialogue continued through the spring and early summer with conference calls, meetings, and the provision of additional items that the ID team was requested to consider in alternative development.

On Tuesday, July 14, 2009, a public collaboration field trip took place. A group of 26 people, including both interested individuals and Forest Service personnel, met together and visited the proposed Creeks II project area. This field trip provided the opportunity for discussion while viewing the stands and resources in question and allowed the participants to use examples to clarify their discussion.

Throughout project development, group selection units have been an area of concern and disagreement over attributes such as size, location, and number, and reason for their use. At the fourth stop, the group engaged in a discussion over the purpose of group selections and where group selection might be effective from differing perspectives. The participants agreed that the stand at this stop was not an appropriate location for a group selection unit because it contains a pine component and the multi-storied stand structure that they would like to see as a greater portion of the proposed project outside of the predominantly red fir area.

The final meeting of the collaborative group took place on October 23, 2009, at the Lassen National Forest Supervisor's Office, in Susanville, California. There were 14 participants: 12 were able to attend the face-to-face meeting and two participated through teleconferencing.

Issues

The proposed action for the Creeks II project generated eleven scoping letters, including nine letters with scoping comments. In the Creeks II project, some issues (listed below) were addressed through design features incorporated into action alternatives, including alternative 3 design features (see appendix A) were developed to reduce or eliminate potential unwanted effects.

Issues Addressed with Design Features Incorporated into Action Alternatives

Effects to Wildlife

Respondents believe that the proposed action could have adverse effects to habitat for California spotted owls, Northern goshawks, and American marten. In particular, respondents expressed concern that implementation of DFPZ treatments in red fir would degrade important habitat attributes.

Modification: A new treatment (treatment M) was designed and included in alternative 3. This treatment would be applied to stands within red fir that have a California Wildlife Habitat Relationship (CWHR) value of 4M or 4D. Treatment M would meet general DFPZ objectives, but focus on long term improvement in marten habitat within the Creeks II project area.

In general, marking prescriptions will be written to retain healthy, vigorous trees of varying size classes and that have a live crown ratio of 50 percent or greater. Ten to 15 tons per acre of large down woody material comprised of logs equal to or greater than 12 inches small end diameter would be retained where it is available and all logs.

Group Selection Units

Group selection units were addressed by several respondents, but their concerns were not the same. Some respondents expressed concern that too few group selection units are included within the project area. Other respondents expressed concern over too many group selection units and the locations of proposed group selection units.

Modification: Proposed group selection units were revisited and ground-truthed. In alternative 2, the modified proposed action, the number of group selection acres was reduced and the location of group selection units was changed.

Based on collaborative discussions, alternative 3 increased the number of group selection acres and changed additional group selection locations to further reflect the intention to enhance stand structure and heterogeneity, and pine restoration. One-quarter to one-half acre group selection units were added within the treatment M units and placed adjacent to existing openings to improve or maintain habitat for marten and their prey base.

In both alternatives, group selection units are avoided within owl territories, except where they meet objectives for owl habitat and where the territory contains more than 50 percent suitable habitat.

Leave (Untreated) Islands within DFPZ Units

Discussions during collaboration meetings and field trips included concerns that treatment A DFPZ units retain little or no understory structure and that it is possible to “see right through them”. This lack of diversity seemed to be counter to a desire for heterogeneity within the project area. Leave islands were included in the design of DFPZ treatments C and O to provide a more heterogeneous structure.

Modification: The continuing collaboration dialogue and site-specific examples during field review provided an opportunity to better describe the attributes included in proposed DFPZ treatments within potential marten habitat. Prescription M includes the leave islands scattered through the unit while still meeting the objectives of a DFPZ for fire fighter safety and space for the fire to be brought to the ground.

Alternatives

This Creeks II Project Draft Environmental Impact Statement documents the analysis of the following four alternatives considered in detail. :

Alternative 1 - No action. Under the no-action alternative, current management plans would continue to guide management of the project area. No treatment activities would be implemented to accomplish project objectives

Alternative 2 - Modified Proposed Action. This alternative was created to respond to the purpose and need for this project. Alternative 2 would employ a combination of commercial timber sales and service, and probably stewardship contracts, and Forest Service crews to 1) protect late-seral values and habitat attributes, 2) develop a DFPZ which is part of a larger network, 3) establish group selection harvest units as directed in the 1999 HFQLG ROD, 4) conduct area thinning, and 5) enhance continuity of DFPZ and area thinning by treating portions of RHCAs on National Forest land within the Creeks II project area. Ideally, treatments would reduce the number of entries required to maintain DFPZ effectiveness for 20 years. The proposed action would implement the direction outlined in Table 2 of the SNFPA ROD (2004).

Included in this proposal are the construction and maintenance of National Forest System roads, the use of temporary roads, and the decommissioning of system and temporary roads. These management activities were developed to implement and be consistent with the 1993 Lassen Forest Plan, as amended by the HFQLG Forest Recovery Act FEIS, FSEIS, and RODs (1999, 2003) and the SNFPA ROD (2004)

Alternative 3 - This alternative was designed to address concerns raised during collaboration. There is no change to types of treatments A, B, C, O, D, E, or F as described in alternative 2. There is a reduction in the number of acres under treatment A, some of which were changed to treatment M. Treatment M has been added to address concerns for forest carnivores. Treatment GS would include a greater range in the size of group selections. This alternative is the agency preferred alternative.

Alternative 4 - This alternative is intended to treat surface and ladder fuels within the Creeks II project area to meet the purpose and need to protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel. This alternative was developed to meet the November 4, 2009 order of Judge England in Sierra Forest Legacy v. Rey requiring all forest management amended by the 2004 Sierra Nevada framework to consider in detail a non-commercially funded fuels reduction alternative for all projects with fuels treatment in the purpose and need. The alternative is designed to remove fuels only to the extent necessary to meet project objectives to:

1. Reduce predicted flame length to less than four feet in fire season during 90th percentile fire weather conditions;

2. Provide an average canopy base height in timbered stands equal to or greater than 20 feet;
3. Reducing fuel loads to less than 5 tons per acre of material less than 3 inches in diameter and less than 10 tons per acre of material 3 inches and greater in diameter; and,
4. Contribute to the continuity of the DFPZ network

Within alternative 4, multiple thinning treatments are proposed using the same treatment unit areas as the alternative 3with the following adjustments:

- Areas in which commercial thinning occurred between 1987 through 2005 have been excluded from proposed treatments under this alternative. Based on the amount of understory removal of trees within those commercial thinnings, the ladder and surface fuel objectives for this alternative have been met.
- No group selection units are proposed.
- No aspen treatment units are proposed.

Table S-1: Comparison of alternatives by treatment

Treatment Category	Treatment	No-action Alternative 1	Modified Proposed Action Alternative 2	Alternative3	Alternative 4
DFPZ	A	0	2995	2085	1735
DFPZ	B	0	94	97	
DFPZ	C	0	178	209	816
DFPZ	O	0	683	815	
DFPZ	M	0	0	1008	952
Total Acres DFPZ		**0**	**3950**	**4214**	**3503**
Area Thin	D	0	1406	1295	2793
Area Thin	E	0	1765	1808	
Total Acres Thin			**3171**	**3103**	**2793**
Group Selection	GS	0	640	660	0
Aspen Enhancement	F	0	299	299	0
Area Thin	RHCA Inner Zones	0	188	188	183
Total Acres All Treatments		**0**	**8060**	**8276**	**6479**

Table S-2: Comparison of road treatments by alternative

Treatment	Alt 1 miles	Alt 2 and 3 miles	Alt 4 miles
New Classified Road Construction (existing unauthorized route)	0	1.91	1.91
New Temporary Road Construction	0	3.57	1.21
Decommission	0	11.09	0
Reconstruct Existing NFS Road	0	2.9	2.90
Use existing unclassified as Temporary Road then decommission(#)	0	5.18	4.6
Proposed Maintenance Level 1 (+)	0	1.61	0
Decommission OHV Trail	0	0.99	0
Road Surfacing (approximate)	0	7.3	0
Road Crossing Surfacing (approximate)	0	72 crossings	0

Responsiveness to Purpose and Need Indicators

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

Table S-3.Responsiveness to purpose and need indicators by alternative

Needs Addressed	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Improve Forest Health, habitat heterogeneity (objectives 1, 4,5,6)				
Number of acres of treatment to reduce SDI[a] below 60% SDI[b]	0	**8060**	**8276**	**6479**
Acres of aspen stands treated	0	299	299	0
Snags per acre	3 (Current levels)	Minimum of 4 – 6/acre	Minimum 4 – 6/acre	4 - 6 acre
Acres with an increase in average stand diameter	0	6,492	6,524	6231
Economic Efficiency(Objective 3)				
Revenues generated		$8,307,089.70	$8,504,562.30	$4,951,568.40
Benefit cost ratio	n/a-	2.04	1.87	1.58
Number of jobs created	0	714	731	425
Income created	0	$31,278,399	$32,021,936	$18,643,971.00
Increase diversity in size class 4 stands (Objective 4)				
Number of/or acres canopy gaps created to enhance stand structure and enhance pine regeneration	0	640	660	0
Watershed Improvement (Objectives7)				
Cubic yards of sediment reduced	No change	25 tons per year	25 tons per year	No Change
RHCA Road density reduced (miles^2)	No Change	2.3	2.3	No Change
RHCA habitat improvement (Objective 8)				
Acres of treatment in RHCA	0	533	533	366
Change in stand density	No change	73 percent reduction	77 percent reduction	77 percent reduction
Change in average stand diameter	No change	45 percent increase	45 percent increase	55 percent increase
Change in percentage max SDI	No change	19 percent decrease	19 percent decrease	13 percent decrease
Change in canopy base height	No change	44 percent increase	44 percent increase	
Change in surface fuels	No change	32 percent decrease	32 percent decrease	

a – SDI or stand density index, is a measure of the stocking density of a stand of trees based on the number of trees per unit area and average diameter of the trees
b - Forests at 60% maximum stand density (SDI max) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to drought.

Fuels objectives

A comparison of the differences in fire behavior potential, ladder crown fuel characteristics and surface fuel loading within the Creeks II project area is shown in Table S-4. All action alternatives provide some degree of reduced level of surface fuel loading ladder and crown fuel characteristics as well as breaking up fuel continuity over the project area.

After comparing the differences among all alternative, alternative 4 meets fuels/fire management perspective to the greatest degree because it meets all of the objectives, including:

- Connection to an existing DFPZ network and create a safe location for fire-fighting personnel to conduct fire-suppression activities.
- Reducing predicted flame length to less than 4 feet
- Reducing fuel loads to less than 5 tons per acre of material less than 3 inches in diameter and less than 10 tons per acre of material 3 inches and greater in diameter.
- Reducing the potential for crown fire both within and outside of DFPZs and area thins by having canopy base heights at 20 feet or above while reducing the number of entries required to meet and maintain DFPZ effectiveness for 20 years.

Alternative 4 would provide the greatest reduction of risk to resources, as all four of the objectives are met. While alternatives 2 and 3 meet three of the four objectives, they would provide the greatest degree of safety to firefighters by having lower predicted flame lengths).

Table S-4. A comparison of the differences among alternatives in potential fire behavior and ladder crown fuel characteristics

Alternative	Fire Type		Flame Lengths (feet)		Canopy base Height (feet)	
	Range	Average	Range	Average	Range	Average
1	Active Crown Fire/Passive Crown Fire	Passive Crown Fire	3.5-6.3	5.1	–4-9	6
2	Surface Fire	Surface Fire	1.2-2.3	2.2	–8-33	19
3	Surface Fire	Surface Fire	1.2-2.3	2.2	–8-33	19
4	Surface/Conditional Crown Fire	Surface Fire	1.2 – 2.4	1.7	–18-22	20

Alternatives 2, 3, and 4 provide a relatively equal reduction in the amount of surface and ladder fuels, predicted flame length and fire type (intensity). Table S-4 also shows comparison of the type of fire that is predicted under 90th percentile fire weather conditions. Under current conditions (alternative 1), the type of fire would be active and passive crown fire. The type of fire expected under the same conditions for alternatives 2, 3, and 4 would be surface fire (Table S-4).

Surface fuels are recognized as one of the primary factors affecting fire behavior. They are a critical component in wildfire initiation and most forms of sustained fire spread on both the forest floor surface and into the crowns of trees. Active wildland fires initially ignite in surface fuels, which influence fire intensity and horizontal and vertical spread based on fuel loading (mass of material in tons/acre), fuel arrangement (vertical and horizontal), fuel type (grass, brush, timber litter, slash), fuel continuity, fuel moisture content, wind speed and direction and slope (Scott and Reinhardt 2001). The amount and type (size) of surface fuels was predicted post-treatment by alternative and compared to existing conditions in Table S-5. Following treatment, surface fuel loads in all treatment areas meet the management objectives outlined in the proposed action. The recommended treatment of these surface fuel profiles with the proposed treatments would reduce the potential for high intensity, stand-replacing wildfires.

Table S-5. Surface fuel loading by alternative in tons per acre

Alternative	0 – 3 Inch Diameter		Greater than 3 inch diameter	
	Range	Average	Range	Average
1	4.5-13.1	9.8	10.0-13.2	11.7
2	1.4-4.9	3.1	2.8-4.4	3.4
3	1.4-4.9	3.1	2.8-4.4	3.4
4	1.5 – 4.8	2.9	3.1 – 3.4	3.3

These numbers do not reflect treatments in RHCAs; see Table 82 for RHCA surface fuels data.

In consideration of operability and stand health, machines that would be used to treat surface fuels by piling down woody material after thinning often damage live trees when operating in restricted spaces. Alternatives 2 and 3 would allow a greater freedom to treat more portions of each stand then would alternative 4 during machine piling/burning surface fuel treatment activities. The relative density of the stands following treatment would be lower under these alternatives (see vegetation section for further details). Because more trees per acre will remain following treatment under alternative 4, machine operability may be more difficult. During machine pile operations in dense stands, trees are more frequently "barked up" from the machines, causing cambium damage to the boles of trees that could lead to tree mortality. Also attributed to density is the higher likelihood that piles would be placed closer to live trees due to limited available space where piles could be placed. The closer piles are placed in proximity to live trees, the greater the mortality rate from radiant heat due to cambial and root damage.

Summary of Effects by Resource

Vegetation

Proposed treatments in DFPZ and area thinning would reduce competition for resources, which would improve overall stand growth and vigor and reduce individual tree mortality; stand densities would decrease as a result of treatments. Thinning would target the removal of damaged and diseased trees and favor retention of trees free of damage and defect. These treatments would increase the species composition of fire resistant trees such as sugar, ponderosa, and Jeffrey pine. Proposed treatments would retain or promote a higher component of pine within mixed conifer and white fir stands. Lower stand densities in the thinned stands would also promote the health of pine, since pine does not grow at the higher stocking densities that white and red fir can persist at. Open stands dominated be larger trees with relatively few scattered understory trees and regeneration are conditions that support low to moderate intensity ground fires. Treated stands would be more resistant to insect attack due to decreased stocking. Group selections would promote the regeneration of pine species and provide stand structure diversity. Forest composition and structure would move closer to desired conditions.

Fire / Fuels / Air Quality

DFPZ treatments and area thinnings would reduce hazardous wildland fire behavior from fires both originating within treatments and from outside point sources (Graham et al. 1999). Treatment of surface, ladder, and canopy fuels would further help protect communities and resources in and around the DFPZs and area thinnings, while increasing safety for firefighters.

Reduction of surface fuels moderates surface fire behavior, allowing for direct attack by hand crews and fire engines. Thinning treatments would reduce wildfire from passive crowning to surface fires in many of the stands. After treatment, reduction in rate of spread means that the fire in the treated areas would be smaller when crews arrive and would be moving slower.

Short duration production of smoke and associated emissions would occur during pile and understory burning. Several communities lie within proximity of the areas where both pile and prescribed burning is proposed to occur. Adherence to the smoke management plan for pile and understory burning would alleviate negative impacts to communities. By adhering to a smoke management plan approved by the Lassen National Forest Supervisor and the Northern Sierra Air Quality Management District, particulate matter emissions from pile or understory burning would not violate California Ambient Air Quality emission standards. Treatment of fuels under all action alternatives would result in decreased smoke production and associated emissions in the event of a wild fire.

Wildlife

Current guidance, supported by recent research (USDA Forest Service 2009), favors a more heterogeneous landscape. However, the implementation of projects that focus on increasing heterogeneity within landscapes dominated by dense mid-seral stands that are also home to focal species such as the California spotted owls or American marten is often controversial. In essence at issue is the question of whether the benefit of implementing certain actions to increase or improve habitat for a broad range of plants and animals (increase diversity) outweighs the risk those actions have on select species. Secondarily, a balance between short-term risks for long-term gains (benefits) must also be considered.

Wildlife issues generally arise when attempting to strike a balance between meeting management objectives such as fuels or forest health and the desire to maintain or improve habitat for focal species, particularly those species associated with late seral habitats such as the California spotted owl and American marten. Many, if not most terrestrial animals that are found in the Lassen National Forest, depend on habitat elements such as understory shrubs which are not commonly found in the dense forests that dominate most landscapes. The direction to retain large tracts of land for key species such as the northern goshawk or California spotted owl, can often have an adverse affect on a number of other terrestrial wildlife species such as migratory birds and species adapted to early seral or open habitats such as rabbits, deer, quail, and grouse. If the desire is to have a landscape with a healthy and diverse assemblage of terrestrial wildlife, then a heterogeneous landscape is essential. Alternatives 2 and 3 are designed to maintain late seral characteristics such as snags, down woody material and large tree diameters while providing for a greater diversity of habitat characteristics.

Shrubs and herbaceous plants play an important part in providing quality habitat, especially in forest communities. Shrubs provide cover as well as food for a number of wildlife. However increases in stand density correlate with decreasing understory vegetation (North et al. 2005, Jameson 1967, Moore and Dieter 1992). In general, canopies over 40 percent, especially in fir forests, generally preclude understory vegetation, except for perhaps fir seedlings (Pase 1958, McConnell and Smith, Moore and Dieter 1992). Shrubs are recognized as an important habitat component whether discussing late seral species such as the marten or spotted owl or early seral wildlife such as deer, quail, or rodents. Habitat exams across the project area have shown that many of the stands within the project area have, on average, less than 25 percent ground cover through shrubs and herbaceous plants; a condition not unexpected given the high canopy densities. Currently approximately 66 percent of the project area is in coniferous forest stands that are at or exceed 40 percent. In a number of stands shrub skeletons are present which serves to illustrate shrubs, and likely forbs, did exist at one point. This decline in understory vegetation would indicate that habitat value, in terms of the value provided by shrubs and forbs has also declined with the increase in canopy densities. Thinning stands would increase the tree growth rates and increase conifer diversity. The creation of group selections in alternatives 2 and 3 would further add a complexity by introducing either pockets of younger trees or shrubs, or both. Alternative 4 would have the greatest impact in terms of reducing habitat value. Although smaller trees are being removed, the strict adherence to the thin from below treatment needed to meet fuels objectives would result in a reduction of near ground cover and a reduction in heterogeneity that is a desired outcome for alternatives 2 and 3.

The density of a stand is important not only from a wildlife perspective but also in terms of the health of a stand and its susceptibility to fire. Stand density is typically measured in terms of the number of trees/unit of land such as a hectare or acre. Consideration should be given not only to the number of trees but also the amount of live biomass as measured through the basal area (the measure of the area of a cross section of the bole of all trees in a stand). This information can indicate how susceptible the stand is to disease and is more thoroughly discussed in the silviculture section.

Summary of Effects to Threatened, Endangered and Sensitive Species

There are no federally listed species that are likely to be impacted by this project. The sensitive species that may occur within the project area include the California spotted owl, northern goshawk, American marten, willow flycatcher, and the Pacific fisher. Although the fisher has been notably absent from the forest since at least the 1940s (Ingles 1947), the recent release of fisher on private lands near the project area requires that the analysis consider this forest carnivore and its habitat.

California spotted owl - Overall, alternatives 2 and 3 would benefit California spotted owl habitat, result in low potential risk, and provide long-term gains in habitat value, with limited short-term risk. Alternative 4 provides less short-term risk due to the reduction in treatment acres and the limited effect to the overstory canopy (most of the canopy loss would be in the understory) however there would be little long-term gain in terms of habitat improvement such as larger trees or a reduction in mortality due to insects or disease.

Northern goshawk- None of the post-fledging areas would meet the ideal conditions however the deviation from the current condition is minimal as few of the stands within the post-fledging areas reach 60 percent canopy cover based on the vegetation layer used in this analysis. The thinning that would occur in the post-fledging areas under alternatives 2 and 3 would increase the ability of the stands to reach the 60 percent canopy cover objective and would maintain or improve the understory foraging conditions.

The activities in alternative 4 would improve the ability for goshawks to forage by reducing the understory and stand density, however each of the five treatments rely on taking out all vegetation up to a given tree size or until 30 percent canopy is reached, except in treatments 4 and 5 (area thin) where 40 percent canopy is considered the minimum. The treatments would be expected to result in an open understory while retaining overhead canopy. The removal of near ground cover (ladder fuels and small logs) material and separating crowns would reduce cover for a number of prey species, although the treatments would reduce the value of the treated areas in terms of roost and nest sites. These habitat conditions are relatively common outside the proposed treatment area therefore the effects are limited.

American marten - The project area is dominated by habitat of low to moderate value (See Chapter 3, Table 68). A review of the information provided through the CWHR program and gained through analyzing the habitat data (see Creeks II wildlife report for specific methods of analysis) indicated that reproductive habitat is generally not lacking. However the elements that provide quality den and rest sites (trees and snags exceeding 30 inches d.b.h.) are lacking and likely in decline. One of the major concerns identified in this analysis is the amount of disease affecting conifers within the red fir stands which provide the highest quality habitat. Under alternative 1 the risk of disease and the potential for fires that would reduce the amount of moderate and high quality habitat would continue to grow.

The wildlife report concluded that alternative 2 would have a marginal effect on marten due to the emphasis on treating habitat of low to moderate value while emphasizing long-term gains in habitat quality. Treatment A would have the greatest adverse affect due to a reduction of habitat quality (loss of structure and overhead canopy); however that treatment affects only a minor percentage of the overall amount of high quality habitat within the project area. Also, the stands that comprise treatment A are generally of low to moderate value for any of the three habitat types (food, cover, or reproduction). Other treatments such as F or the group selections, while affecting habitat provide localized effects (treatment F), or is in the case of group selections, the effects are spread out and would have a limited affect on available habitat. Group selections sites were chosen for their contribution to habitat diversity and were placed in younger white fir stands. The group selections would affect a limited portion of the stand in which they occur and are not expected to affect marten movements. Based on the site visits completed when establishing the groups, the habitat quality within the proposed groups is of limited value and therefore the reduction in habitat value would not contribute to a loss of important habitat characteristics.

Alternative 3 provides for a greater opportunity to enhance marten habitat by addressing the disease and fuels issues but also providing design criteria that specifically address the retention of key habitat elements. This alternative also retains a higher canopy in those stands with high quality attributes while allowing treatments that would improve long term conditions in those stands lacking quality habitat attributes. With the addition of treatment M, alternative 3 has the greater potential to improve habitat in the short term and retain those key elements into the future. Under this alternative, the amount of high quality reproductive habitat would increase (generally as a result of thinning smaller trees, increasing the overall average tree size, moving it into the next size class). Leave islands also provide a means to retain key habitat attributes such as large logs which provide critical rest and denning structure.

Forage habitat declines under alternative 3 but forage habitat is generally not considered a limiting factor. The changes in reproductive habitat include habitat moving from moderate to both high and low value due to changes in the CWHR values. As mentioned, reproductive habitat is fairly abundant and the suitability value indicates that project area is providing moderate to high value reproductive habitat overall. Group selections in this alternative would provide for continued small openings in the red fir (groups were generally removed from red fir in alternative 2) which would keep the small openings intact. Field reviews have shown these areas to be rich in rodents, providing abundant prey.

Alternative 4 would have the greatest impact in terms of reducing habitat value. Although smaller trees are being removed, the strict adherence to the thin from below treatment needed to meet fuels objectives would result in a reduction of near ground cover and a reduction in heterogeneity that is a desired outcome for alternatives 2 and 3 due to the objective of separating crowns and reducing ladder fuels.

Willow Flycatcher - None of the alternatives directly affect the willow flycatcher site and it is not feasible to quantify any risks or benefits that may result from direct or indirect effects.

Pacific Fisher- Based on the most recent habitat models and research on fisher habitat, the project area provides neither suitable habitat, nor does it provide a likely corridor to and from areas of high quality habitat. Therefore none of the alternatives would provide any direct or indirect effects.

Determination of Effects to Terrestrial MIS

Although habitat value was likely to decline due to short term changes under all alternatives, the MIS report determined that none of the alternatives would result in a change in habitat trend for any of the MIS considered or change current population trends of MIS at the bioregional scale.

Migratory Birds

A review of the projects' potential effects to migratory birds was completed for this project. The review determined that alternatives 2 and 3 would provide increases in the amount and quality of habitat for migratory birds. Alternative 4 would also increase habitat but to a lesser extent and the quality of the habitat created would be less. This determination was based on reducing canopies, potential increases in understory vegetation, retention of snags and downed logs, and increases in 5S and 5P habitat, which are characterized as having sparse to open crown closure, with trees over 24 inches d.b.h. on average.

Soils

The risk of negatively affecting soil productivity is low for the proposed project activities. The project would be implemented with integrated design features designed to avoid or reduce the potential negative effects of the proposed activities on soil resources (integrated design features, appendix A). Based on a combination of field surveys and estimates of cumulative disturbance using equivalent roaded acres, soil quality guidelines for soil hydrologic function would be met in all project subwatersheds, as would soil productivity standards.

Watershed and Fisheries

The proposed actions were designed to minimize potential adverse impacts to aquatic habitat within the project area in recognition of existing watershed conditions due to lasting impacts of the Storrie fire, high road densities and high number of road crossings.

Based on the results of the cumulative watershed effects analysis, implementation of BMPs and integrated design features (including RHCA designations and prescriptions), the risk of adverse cumulative effects to aquatic resources within the project area is low and beneficial uses of would be maintained. The analysis concluded that there is no loss of aquatic/riparian habitat and therefore there is no cumulative contribution to the loss of suitable habitat for aquatic and riparian dependent species within the HFQLG Pilot Project Area.

Sediment / water quality: Disturbance due to mechanized treatment, road maintenance, and road reconstruction would increase risk of erosion and sedimentation in the short term; however, integrated design features and BMPs would minimize this risk. Road decommissioning, road surfacing, and the reduction of severe wildfire risk would reduce the risk of erosion and sedimentation in the long-term.

Aquatic Habitat: Possible slight change in large wood characteristics, slight reduction in stream shading, some possible short term minor impacts, but long term improvement. The risk of indirect effects to water temperature and channel shade is considered low. The proposed actions within inner zone RHCAs were developed to improve conditions adjacent to streams and within sensitive riparian areas to historical conditions, trend towards a more fire resilient ecosystem, and increase the proportion of channel shade provided by hardwoods. However, thinning and aspen enhancement actions proposed within inner zone RHCAs would result in short-term decreases in channel shade at the stand scale. Due to the limited area proposed for RHCA thinning (148 acres; 8 percent) and aspen enhancement (74 acres; 4 percent), decreased channel shade would not result in significant increased water temperatures on the sub-watershed or project scale.

Cumulative Effects: Risks of cumulative effects would increase slightly due to the proposed action plus past activities. Cumulative effects would continue on private timber lands, but would decrease across many of the sub-watersheds with further recovery of fire area.

Decommissioning of roads and surfacing at stream crossings would further reduce risk of cumulative effects across these sub-watersheds under alternatives 2 and 3. Although there are less acres being treated in alternative 4 than alternatives 2 and 3, there would be a higher overall risk for sediment erosion and delivery. There are two primary reasons for this increased risk: first, the decommissioning of the unneeded roads and OHV trails and their associated stream crossings would not occur. These features would continue to erode and pose long term risks to water quality. Second, the surfacing of crossings included in alternatives 2 and 3 have been removed from this alternative. Pre-haul maintenance and an increase in traffic would cause more erosion from the roads used in the project. There would be fewer new temp roads that would be needed for the project.

Aquatic Species

Summary of Effects to Threatened, Endangered, and Sensitive Species

There are no federally listed species that are likely to be impacted by this project. The sensitive species that may occur within the project area include Cascades frog and Sierra Nevada yellow-legged frog.

Cascades frog – Alternatives 2, 3, and 4 would result in a potential low risk of direct effects to Cascades frogs where mechanical equipment and felling of trees would be implemented within or adjacent to potential suitable habitat. Alternatives 2, 3, and 4 would result in potential low risk of indirect effects to potential suitable habitat which includes perennial waters, springs, and wet meadows in the project area. Alternative 2 and 3 would result in a low potential for beneficial indirect effects to potential suitable habitat within aspen enhancement treatment units located in wet meadow habitat. All action alternatives would result in a low potential for cumulative effects to potential suitable habitat for Cascades frogs.

Sierra Nevada yellow-legged frog - Alternatives 2, 3, and 4 would result in a potential low risk of direct effects to Sierra Nevada yellow-legged frogs where mechanical equipment and felling of trees would be implemented within or adjacent to potential suitable habitat. Alternatives 2, 3, and 4 would result in potential low risk of indirect effect to potential suitable habitat which includes perennial waters, springs, and wet meadows in the project area. Alternative 2 and 3 would result in a low potential for beneficial indirect effects to potential suitable habitat within aspen enhancement treatment units located in wet meadow habitat. All action alternatives would result in a low potential for cumulative effects to potential suitable habitat for Cascades frogs.

Summary of Effects to Aquatic MIS

Because the risk of potential direct, indirect and cumulative effects to aquatic MIS species habitat is considered low, the project will not lead to any changes in habitat trend for this aquatic MIS at the bio-regional scale. In general alternative 2, 3, and 4 should result in improved quality of aquatic MIS habitat within the project area subwatersheds, and a slight potential for expansion of wet meadow habitat at the site scale.

Botany

Under alternatives 2-4, potential effects to plants involve physical damage to the plants or their habitat, such as crushing, breaking, or burning the plants; burying them under displaced slash or duff; or disturbing/compacting the soil. Such damage can kill the plants. With the implementation of the integrated design features (See appendix A), no direct effects to known occurrences of *Meesia triquetra, M. uliginosa, Botrychium minganense* or *B. montanum* are expected. All known occurrences would be flagged and avoided, and the fens and associated meadows where *Meesia triquetra, M. uliginosa* and *Botrychium minganense* species occur in would receive a 150 ft buffer as part of the integrated design features for wet meadows (fens). In addition, all known occurrences of *Botrychium minganense* and *B. montanum* are found outside of proposed treatment units.

Under alternatives 2-4, potential indirect effects include an increase in noxious weeds or other undesirable non-native species as a result of project activities. The noxious weed risk assessment (located in the planning record) completed for this project determined an overall low to moderate risk of potential weed spread with the implementation of the proposed treatments. In addition, the standard practice of equipment cleaning and integrated design features of avoiding or treating noxious weed infestations within the project area would reduce these potential effects.

Possible indirect effects to *Botrychium* spp. could occur if the hydrology of associated meadows springs or streams were to be altered during project activities. As with direct effects, impacts are most likely to occur within the inner zones of RHCA and aspen enhancement units throughout the project area. These areas are for the most part are protected from direct disturbance by mechanical equipment, due to the "dry" soil requirement for the project, so any impacts to these areas should be avoided. However, small seeps and spring missed during surveys could be impacted, and treatments in riparian areas even when soils are dry could alter hydrology on a small scale, especially with mechanical equipment. As a result, while there may be scattered impacts to unidentified *Botrychium* spp. occurrences and potential habitat by the implementation of alternatives 2-4, these should not be detrimental to the viability of the species within the project area or throughout its range.

Summary of Effects to Sensitive Plants

No threatened or endangered plant species occur within the project area, and they will not be considered further in this analysis.

According to the botany biological evaluation (Botany BE) for the Creeks II project (planning record) the following determinations have been made by the Forest Botanist:

With implementation of project integrated design features, including 150-foot buffers around all known fens, alternatives 2-4 will not affect *Meesia triquetra, Meesia uliginosa* or *Oreostemma elatum*, since no direct, indirect, or associated cumulative effects will occur.

Implementation of the Creeks II Project alternatives 2-4, may affect individuals of *Botrychium ascendens, B. crenulatum, B. minganense, B. montanum, B. pinnatum*, or *Silene occidentalis* ssp. *longistipitata*, but is not likely to result in a trend toward Federal listing as threatened or endangered or loss of viability for these species.

Economics

The implementation of the proposed action provides public benefits such as local jobs, income generated from the forest products industry, and energy from local cogeneration plants.

Heritage Resources

There is the potential that sites (unanticipated discoveries) do exist that are currently obscured by vegetative cover. Unanticipated Discoveries are to be mitigated using the guidelines put forth in the Regional Programmatic Agreement - Section 106 Compliance Sites with a high probability to be adversely affected by this project are in the process of being evaluated for National Register eligibility.

In the past, heritage sites have been lost to wildfires. Sites within the current project area would be adversely affected by high-intensity wildfire. Under the proposed action alternative, fewer sites would be lost from wildfire due to the removal of hazardous fuels. Known sites would receive protection from project activities. Therefore, there would likely be small, beneficial cumulative effects from the proposed project on heritage resources.

Range

Under the action alternatives grazing on the active allotments (Soda Creek/North Butte) is expected to continue at current levels, which is at its lowest point when compared to historic levels. Impacts from this alternative would be minimal to the vacant allotments or to those permittees taking or expecting to take non-use. Proposed treatments could have a positive effect on rangeland availability and health by creating additional forage within the treated areas. Forage production and accessibility could be increased on up to approximately 10,600 acres within the allotments, and new areas of transitory range could be created which could improve livestock distribution and use patterns.

Recreation / Visual Resources

Long-term effects of the project would be an improvement to the over- all health of the forest and safety from wildfire thereby improving recreation opportunities in the future. People familiar with the area, especially those who return each year such as hunters and anglers would be most aware of any limitations to recreation activities during project implementation. New or occasional visitors would be less aware of changes. Design features would lessen the short-term effects to recreation (see appendix A).

Propose d treatments would maintain a dominance of mature forest character. Alterations proposed would be made in such a way as to minimize their negative contrast with the landscape and move the stand toward its desired long-range goal. Slash and other logging debris would be eliminated so as not to be visually evident. Some stumps may be visible in the foreground, however, as vegetation re-grows, the negative effect would lessen.

Wildfire could permanently change the vegetative composition of the forest resulting in scenery with very negative appearance for 3 to 10 years and a different type of scenic expression thereafter. Alterations proposed would be made in such a way as to minimize their negative contrast with the landscape and move the stand toward its desired long-range goal and prevent catastrophic, wildfire induced changes to the long-term visual condition.

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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:* The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences*: This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area.
- *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 the Almanor District Office.

Background

Location and Description of the Project Area

The project area is located in the Butt Creek Management Area (MA 37) and Soda Ridge Management Area (MA 45) in the Almanor Ranger District of the Lassen National Forest. The general location is approximately 12 miles southwest of Chester, California, within Plumas County. The project area encompasses about 33,000 acres and is located in all or portions of: T. 26 N., R. 5 E., sec. 1-4, 10-15, 23-26, 35, 36; T. 26 N., R. 6 E., sec. 1-12, 17-22, 29-31; T. 27 N., R. 5 E., sec. 13-15, 20-29, 32-36; T. 27N., R. 6 E., sec. 2, 3, 9-11, 14-21, 26-35,of the Mount Diablo Meridian. See the vicinity map, Map 1.

The Creeks II project area overlaps portions of ten sub-watersheds that contribute to Yellow Creek, Butt Creek and the North Fork Feather River and ultimately drain into the Sacramento River (Figure 25). Land ownership in these ten affected sub-watersheds includes lands managed by the Lassen National Forest (48,506 acres), private (28,662 acres), and the state of California (74 acres). The majority of private lands are managed for timber production with the exception of Humbug Valley that historically has been managed for grazing resources.

The project area is located at the transition between the Sierra Nevada and Cascade Mountain ranges. The project area is characterized by a Mediterranean climate with warm and dry summer conditions and cold and wet winters. Annual precipitation ranges from 37 inches at Chester (6 miles northeast of the project) to 80 inches at higher elevations (Humboldt Peak). Most of the precipitation comes as snow rather than rain, though warm rainstorms do occur each year. Annual snow depths range from three to five-feet at Chester, while at the higher elevations greater depths are common.

Topography in the project area is gently sloping terrain to steep mountainous landforms. Elevations of the project area range from approximately 4,300 feet to nearly 7,000 feet. Soils in the Creeks II project area are derived mostly from weathered volcanic parent rock with some derived from weathered granitic, metavolcanics and metasediments. There are a high percentage of surface rocks within the project area. Depth to bedrock varies widely from less than 20 inches to over 60 inches, with the majority of soils being 30-40 inches deep.

Condition of Project Area

Historical references that describe forest structure, composition, and function are important to understanding how these fire-adapted ecosystems evolved and were sustained on the landscape over time. Comparing historical and existing conditions provides a baseline for understanding the desired conditions described in the Lassen Forest Plan. Historical information also provides an example of forest conditions when landscapes were naturally resilient to wildfire and diseases that currently affect today's forests.

Prior to the inception of organized fire suppression that coincided with the establishment of the Lassen National Forest in 1905, fires tended to be more frequent and of lower intensity. According to one study (Beatty and Taylor 2001), the average fire rotation (the amount of time it took for fire to affect the entire area) in the Cub Creek drainage, located just northwest of the project area, was approximately 30 years. In contrast to the historic conditions described by Beatty and Taylor (2001), the fire rotation in the study area has increased to as long as once every 407 years. Fire return intervals (the amount of time between fires) have increased within the study area from 7.7 years, on average, to over 30 years. This increased fire interval has, in turn, led to larger individual fires with much larger areas of high intensity (stand-replacement) burns (Beatty and Taylor 2001). This study also indicates that fires that occurred during the pre-suppression period were frequent and were predominantly low to moderate in intensity, except in upper drainages where fire was generally of a high intensity. The low- to moderate-intensity fires decreased both ladder and surface fuels by consuming patches of surface fuels and killing mostly seedlings and saplings in the understory (Kilgore and Taylore 1979). This contributed to a heterogeneous landscape of conifer communities varying in density and interspersed with shrubs.

Conditions fostered by a century of fire suppression, a climate favorable for conifer regeneration and growth, and past management activities including overstory removal have perpetuated dense stand conditions. These dense stand conditions threaten the long-term development and persistence of late-seral habitat. In addition, these dense stand conditions are not favorable for the regeneration of shade intolerant ponderosa pine, Jeffrey pine, and sugar pine (collectively "pine") and the past removal of large pine trees from the overstory has also contributed to a reduction in the overall pine component. Instead, white fir, a shade tolerant species, has proliferated under the existing conditions and is the species primarily responsible for dense stand conditions in the Creeks II project area. Conifer mortality increases when trees are under stress from a lack of soil moisture, especially after several years of below normal precipitation (Guarin and Taylor 2005). Existing high stand densities place the large tree component of late-seral stands at increased risk of mortality from insects and disease, especially during times of prolonged drought.

Dense stand conditions also increase the likelihood that wildfire will move into the forest canopy and result in a high-intensity fire that changes the vegetative character over large areas of forest. Much of the existing habitat considered suitable for both California spotted owl and American marten is composed of densely forested stands, increasing the risk that wildfire poses to these habitats. The USDI Fish and Wildlife Service and Forest Service both have identified stand-replacing fire in unnaturally dense forest stands as a primary threat to California spotted owls. This threat includes the loss of owl habitat and subsequent decrease in owl population (USDA Forest Service 2004, USDI Fish and Wildlife Service 2006). One purpose of the Creeks II project is to reduce the potential for stand-replacing fire and the loss of habitat that results from such fires.

The changes that have occurred on the landscape from various management activities, including fire suppression, are reflected in the comparison of stand conditions today to conditions reported from the early land survey records. Comparisons between historical and contemporary conditions have been made at several locations around the Forest. The original land surveys, completed during the 1880s, recorded the tree(s) nearest the corner marker for each section. Locating the original corners and measuring the tree(s) currently nearest those corners has shown a consistent change in species composition across the forest. There has been a substantial decline in the amount of shade intolerant species (pine), an increase in shade tolerant white fir, and a decrease in the mean diameter at breast height (d.b.h.; diameter measured at 4.5 feet from ground level) of trees within the stands. One such review showed pine reduced from 43 percent of the species mix to 27 percent. Another review resulted in the median d.b.h. shifting from 30-inch to 12.3-inch. The number of trees compared to the 1880s has increased nearly four times (Figure 1), and as noted above, the average diameter is smaller today. The two primary factors that have influenced the change in tree diameters over time are fire exclusion, which caused an increase in tree numbers in smaller size classes, and management practices of the 1950s – 1980s that emphasized the removal of large over story trees.

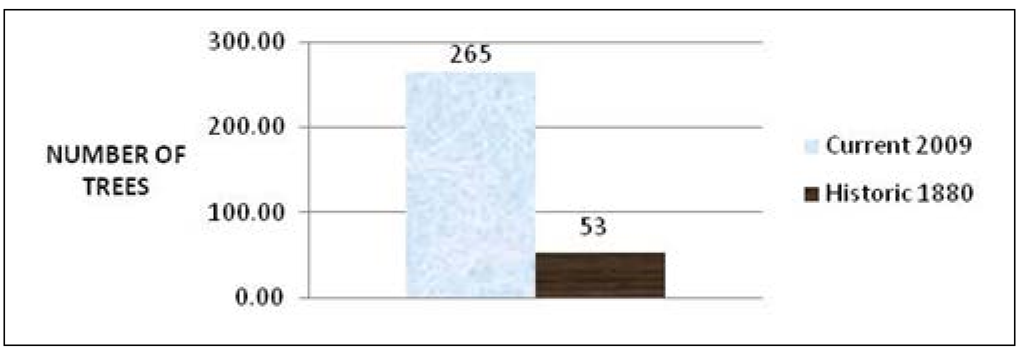


Figure 1. Current vs. historical data: trees per acre

Another example of the changes between historic and contemporary conditions is the average distance between trees is illustrated in Figure 2. The average distance between trees not only tells us how far apart trees were on average, but the data can also tell us about the spacing, whether the spacing is rather uniform or variable and the degree of that variability. In Figure 2 the average distance between trees historically was approximately 43 feet and trees may have been as close as ten feet or more than 75 feet apart. This infers that trees were both clumped and with wide gaps between the clumps of closely spaced trees. By comparison, the distance between trees today is substantially less and the data indicates a much more uniform spacing. The importance of a high degree of variability between trees as a habitat feature (structural heterogeneity) was recently discussed in the general technical report *An Ecosystem Management Strategy for the Sierran Mixed-Conifer Forests* (USDA Forest Service 2009) and was evidently much more prevalent prior to the turn of the century. Variable spacing provides dense structure that old forest species prefer while infusing more open areas which provide the shrub and herbaceous layer that other species prefer. This diversity historically occurred at both the stand and landscape level.

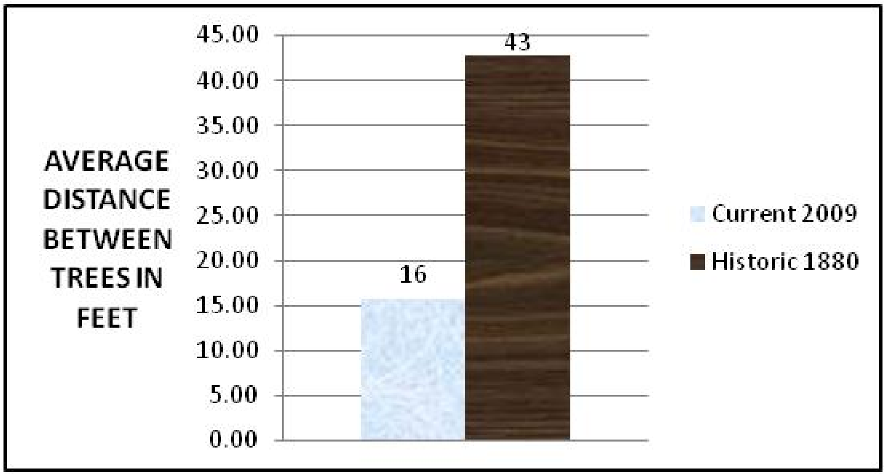


Figure 2. Comparison of historical vs. contemporary conditions: distance between trees

Activities that directly affected the coniferous habitat within the project area began largely after the 1940s. The 1948 Almanor District Map shows that roads had been built on the northeast and eastern portion of the project area. By the mid 1960s, aerial photos show roads covered most of the project area with extensive logging on the east side of the project area. However logging in the southern portion (Panhandle Creek, Grizzly Creek, and Peacock Point) and the red fir vegetation types on the west side, did not begin until the 1970s. From the mid-1980s to the early 1990s treatment focused on removing the larger trees and opening up stands to encourage conifer regeneration. Since 1993 there has been comparatively little activity and the treatments conformed to the requirements under the CASPO EA (USDA Forest Service 1993) direction which generally resulted in even-aged stands of moderate sized trees with little understory.

History of Project

Legal Proceedings

A proposal to address fuels and forest health issues within the Creeks Forest Health Recovery Project (Creeks) area of the Lassen National Forest was placed on the Lassen National Forest Schedule of Proposed Actions in February 2004. The project was sent to the public for scoping in 2004 and the Responsible Official, the Lassen National Forest Supervisor, signed the Record of Decision (ROD) for Creeks in September 2005. A lawsuit was filed and in August 2006, the Creeks analysis and Decision was remanded to the Forest Service by Judge Damrell, Eastern District Court of California.

In its decision, the court found several deficiencies within the Creeks Final Environmental Impact Statement (FEIS) and ROD including

- A failure to analyze an adequate range of alternatives, particularly alternatives involving less intensive logging.
- A failure to take a hard look at environmental impacts relating to the American marten and California spotted owl.

- A failure to assure viable, well distributed populations of American marten and California spotted owl.
- A failure to meet the requirements for Management Indicator Species (MIS) by approving the project without appropriate or sufficient population and habitat data for the American marten, the pileated woodpecker, and the black bear.

In January of 2006, approximately one month prior to initiation of litigation of the Creeks decision, three timber sales within the analysis area were awarded to a single successful purchaser. From the outset of this planning process, the Forest Service determined and the agreed that any changes to treatments and prescriptions proposed within the planning area would not be hindered or constrained by the existence of these timber sale contracts. In addition, changes to the project as a result of the Creek s II planning process and analysis may require modifications to the contracts, including the deletion or addition of acres proposed for treatment, as well as changes to the prescriptions used to carry out the various treatments.

During the winter of 2006 and the spring of 2007, an interdisciplinary team (ID Team) was convened to review the court decision and the public responses to the Creeks project. The original Creeks project was designed to implement the HFQLG Act, and the selected alternative addressed comments by including mitigations to the proposed action. That project was not developed with an intention to enhance habitat for wildlife species of concern and objectives for group selection units included an emphasis on volume.

The team determined that both the public and the forest lands would be best served by developing a project with a focus on the specific concerns of wildlife habitat and habitat connectivity; taking action to improve overall forest health; and, reducing the risk of large, intense wildfires while providing firefighters with safer areas from which to attack a wildfire. With this change in focus, a new approach to project design and analysis was warranted.

Creeks II Project Development

A new purpose and need statement was crafted to address the specific concerns highlighted within the original Creeks project resulting in the Creeks II project that is analyzed within this draft environmental impact statement (DEIS). The Creeks II project boundary encompasses the same project area as the original Creeks analysis, but the focus has changed and the proposed actions have been refined.

District and Forest staff met with John Keene, Herger-Feinstein Quincy Library Group (HFQLG) Administrative Study Owl Module Leader, Pacific Southwest Research Station (PSW), Davis, California, to discuss the concerns brought forward by Judge Damrell and in the public responses. Mark Williams, district wildlife biologist, and Keene worked on new prescriptions and an analysis strategy to determine impacts to the California spotted owls within and adjacent to the Creeks analysis area. The method developed helped guide proposed project elements and the placement of treatments across the landscape. The proposed project design considers the status of the owl within the proposed project area, which falls within the Lassen Owl Demography Study area.

District and Forest staff also began work with Bill Zielinski, Redwood Sciences Lab (PSW, Arcata, California) to address Judge Damrell's ruling regarding marten. The ID Team recognized that the court's concerns surrounding the American marten were based primarily on a report (Zielinski et al. 2005) that stated there was a distribution gap in marten between the Lassen Volcanic National Park (LVNP) and the southern end of the Plumas National Forest (PNF). This report conflicted with many years of local survey data collected by the district and forest and used in the original analysis for Creeks. To help resolve the difference in information, the Forest Service and PSW developed a cooperative study in conjunction with Oregon State University to determine the status of marten in the Lassen National Forest. The data gathered through this new study will also help in the evaluation of the effects of forest management activities on marten and their habitat. The project design incorporates findings from research to resolve marten habitat connectivity, which has been and continues to be a concern of the Sierra Forest Legacy (SFL) collaboration participants.

The summer of 2007 provided an opportunity for representatives of the SFL to participate in a field review of four HFQLG projects proposed in the Lassen National Forest. Meeting in the field helped to clarify discussions of various concerns such as crown closure, owl habitat, marten habitat, upper diameter limits, and group selection placement criteria by providing site-specific and on-the-ground points of reference. Though a total consensus was not reached, discussions did provide clarification of the various actions considered under alternatives 2 and 3 as well as defining areas of common agreement. These discussions and the exchange of ideas assisted the ID Team in framing the treatments proposed in the Creeks project.

These discussions continued in the fall of 2007. Forest and district staff, as well as a representative from the Office of General Council, met with SFL representatives in Sacramento. Mark Williams used a power point presentation to describe impacts to old-forest dependent species within the Creeks II project area. The group then continued the meeting with a discussion of the proposed treatments within the project area designed to accommodate and benefit California spotted owl and American marten and their respective habitats. The same power point was presented to representatives of HFQLG and interested forest industry representatives in November 2007, along with a discussion of the same proposed treatments and locations. Both meetings provided additional opportunities to clarify concerns and to discuss the impacts of these concepts in current and future HFQLG projects. These discussions, and the concerns and support expressed, continued to shape the proposed action.

On December 27, 2007, the HFQLG Act was amended by H.R. 2764 to utilize the analysis and objection process identified under H.R. 1904, known as the Healthy Forest Restoration Act of 2003 (HFRA). The Omnibus Appropriations Act of 2009, H.R.1105, which became Public Law Number 111-8 on March 11, 2009, further amended the project by making sections of the HFRA applicable to HFQLG projects with a fuels reduction component.

HFRA projects are not subject to the 36 CFR 215 regulations for notice, comment, and appeal. Instead, HFRA has a pre-decisional objection process. As part of that pre-decision emphasis, there are distinct requirements for collaboration, public involvement, and alternative development. In part, HFRA directs

- Collaboration (HFRA, Section 104(f)) – The Forest Service shall facilitate collaboration when preparing HFRA projects.
- Public Meetings (HFRA, Section 104(e)) – The Forest Service must conduct a public meeting when preparing an HFRA project.
- Alternative Development (HFRA, Section 104(c) and (d)) – The requirements for a range of alternatives analyzed in an EIS developed under HFRA vary based on land description, including whether the project location is within or outside of Wildland-urban Interface (WUI). The Creeks II project includes area outside of WUI, and as such, the required alternatives are:
    - The proposed action,
    - The no-action alternative, and
    - One additional action alternative if one is proposed during scoping or the collaborative process. If more than one additional alternative is proposed during scoping or the collaborative process, the Forest Service must select one and provide a written record describing the reason for its selection.

The district applied HFRA regulations to all HFQLG projects, including Creeks II. In February 2008, the Almanor Ranger District held a public collaborative meeting to discuss the HFQLG projects in process at that time. One of the projects discussed at that meeting was Creeks II. The draft proposed action for Creeks II generated 13 letters with pre-scoping comments and a request from SFL for a telephone conference to cover pre-scoping questions as no representatives were able to attend the meeting. In March 2008, there was a telephone conference between Lassen National Forest Supervisor, the Almanor Ranger District, and representatives of the SFL and the Lassen Preservation Group to discuss how HFRA would impact the Creeks II project and the NEPA process, and to continue conversations about treatments proposed with Creeks II and how they may affect owl and marten strategies.

On November 4, 2009, Judge Morrison C. England, Jr., issued an order for the *Sierra Forest Legacy v. Rey* case. The order requires all forests with Land and Resource Management Plans that were amended by the 2004 Sierra Nevada Framework to consider in detail a noncommercial funding fuels reduction alternative for all projects with a fuels treatment in the purpose and need. The order was applicable to treatments proposed with the Creeks II project.

On May 26, 2011, the Ninth Circuit affirmed the District Court's NEPA ruling that the 2004 Sierra Nevada Framework complied with NEPA in all respects, except for the Framework EIS's consideration of alternatives. The Court of Appeals reversed the ruling on remedy and has remanded the remedy question back to the District Court for further consideration. This has the effect of lifting the requirement for project-level consideration of a non-commercial funding alternative for fuels reduction. However, when the remand process is complete, Judge England could reinstate his injunction. As a result, alternative 4, a non-commercial fuels alternative was analyzed in detail with this environmental impact statement.

Management Direction

Forest Plan

The Creeks II project would be managed under the 1992 Lassen National Forest Land and Resource Management Plan (Lassen Forest Plan), as amended by the Herger-Feinstein Quincy Library Group Forest Recovery Act (HFQLG) ROD (USDA Forest Service,1999, 2003), and the Sierra Nevada Forest Plan Amendment ROD (USDA Forest Service 2004) and the Management Indicator Amendment (USDA Forest Service 2007). The Lassen Forest Plan, as amended, includes direction for forest management, goals and objectives, standards and guidelines, area management direction, and the anticipated outputs of forest products.

Table 1. Standards and guidelines applicable to the Creeks II project

Section	Title	Number	Statement
19	Timber	A3	Manage the landscape to provide a mosaic of even-aged and uneven-aged timber lands.
		A9	Design the size, shape, and distribution of openings to meet objectives for visual quality, recreation, fire management, and wildlife habitat ….
		A16	Where vegetation competition will substantially inhibit tree survival and growth, analyze a full range of available vegetative management techniques.
		A18	Provide a diversity of tree species and mix of size classes when commercial thinning uneven-aged stands.
20	Vegetation and Diversity	A	Provide vegetative diversity to maintain scenic quality, viable populations of plants and wildlife, and to minimize loss from wildfire.
22	Water and Riparian Areas	D1	Maintain or improve riparian-dependent resources in and around wetlands, stream corridors…..
25	Wildlife	D	Created desirable habitat, size, shape, and distribution to provide both forage and cover for deer populations.
		E	Provide sufficient habitat for species dependent on snags.

Table 2. Management area direction

Management Area	Standard and Guide Area	Direction
37 (Butt Creek)	Wildlife	Continue improvement of riparian, meadow, and stream habitats along Yellow and Butt Creeks.

Purpose and Need for Action

Congress has directed the Forest Service to implement a pilot project to demonstrate the effectiveness of certain management activities through the Herger-Feinstein Quincy Library Group (HFQLG) Act. The HFQLG Forest Recovery Act pilot project is designed to test and demonstrate the effectiveness of certain fuels and vegetation management activities in meeting ecologic, economic, and fuel reduction objectives to the extent consistent with applicable federal law. Fuels and vegetation management activities include constructing a strategic system of defensible fuels profile zones (DFPZs), group selection, and individual tree selection (area thinning). A management program for riparian areas was also identified. Forest Supervisors for the Plumas, Lassen, and Tahoe National Forests signed a ROD for the HFQLG FEIS in August 1999. The ROD amended the three-Forest forest plans to establish a pilot project to demonstrate and test the effectiveness of these management activities. These management tools were incorporated into the design of the Creeks II project and are identified by objective.

In developing the Creeks II project, the Interdisciplinary Team (ID Team) incorporated long-term forest health goals, including habitat, by proposing treatments designed to retain or develop stand structures that promote vegetative heterogeneity at both the stand and landscape level. The elements of forest health that are emphasized within Creeks II are sustainability, plant species diversity and structural complexity at both the stand and landscape level, and insect and disease that are endemic (within normal parameters). Creeks II would utilize a landscape approach to retain habitat throughout the project area based primarily on the needs of species like the California spotted owl and American marten that are adapted to late-seral habitat conditions. Equally important to developing stands that would attain the late-seral habitat elements over time are efforts to perpetuate late-seral habitat by reducing the overall fire intensity should a wildfire occur (USDI Fish and Wildlife Service 2006, Johnson and Franklin 2007).

Objective 1-Improve tree vigor, growth, and insect and disease resistance by reducing stand densities and by favoring the retention and development of pine species.

The HFQLG Act directs the use of area thinning to thin the forest canopy and increase resources available to remaining trees, while some overstory canopy is left in place. The Creeks II project proposes area thinning to remove trees smaller than the selected tree (or clump of trees) for a prescribed distance with the goal to provide more resources to the focus tree(s) and to recruit trees that develop attributes preferred by late-seral species.

The Creeks II project area thinnings are designed to contribute to goals of the 1998 HFQLG Act while meeting requirements of the amended Forest Plan. The Forest Plan provides the following applicable guidance: Provide vegetative diversity to maintain scenic quality, viable populations of plants and wildlife, and to minimize loss from wildfire (A-20). Where vegetation competition will substantially inhibit tree survival and growth, analyze a full range of available vegetative management techniques (A-16). Provide a diversity of tree species and mix of size classes when commercial thinning uneven-aged stands (A-18).

Specifically, one of the objectives for all treatments is to maintain stand densities below or close to 60 percent of maximum stand density index[1] for 20 years after thinning to improve tree vigor, growth, and disease resistance and to limit the need for re-entry for further treatments to maintain these attributes. Minimizing reentry provides time for watersheds to recover from disturbance associated with project activities. To stay below or near 60 percent of maximum stand density index for 20 years for this project area, the desired immediate post-treatment stand densities would be near 40 percent of maximum stand density index. This level would retain the habitat attributes that are currently present and provide for forest health conditions that contribute to improved tree vigor, growth, and disease resistance.

Need

Current vegetative conditions in the Creeks II project area reflect the consequences of past management practices described above and are characterized by dense forest stands and heavy fuel loads (surface and ladder). Several recent research efforts focusing on conifer mortality within the Sierra Nevada range (Guarin and Taylor 2005, van Mantgem and Stephenson 2007) have added to a growing body of evidence that the dense stands common in forest communities today are at an increasing risk of loss on a large scale from insect and disease, if not from wildfire. The Forest Service Forest Health Technology Enterprise Team (FHTET) completed risk assessments for forests throughout the United States (FHTET 2007-06, August 2007). One product of the assessment was risk maps that estimate the potential for mortality through a variety of causal agents like the mountain pine beetle, root diseases, and fir engraver beetle. The mapping, although very coarse in scale, clearly shows that the project area meets the minimum criteria for FHTET risk mapping. The risk to pine is of particular concern because pine has already been substantially reduced through previous logging and regeneration of pine is severely limited due to stand densities. The mountain pine beetle was ranked the top mortality agent of the more than 40 agents of mortality recognized in the study, indicating another high risk to the remaining pine.

On a landscape level, prolonged drought conditions can lead to widespread conifer mortality due to insects and disease in stands that have become so dense that there is competition for space and resources such as light, nutrients, and soil moisture (Guarin and Taylor 2005). Prolonged drought conditions, defined as two or more consecutive years of below normal precipitation have occurred in half the decades since 1905 in the project area, as determined by a review of the Western Regional Climate Center historic rain data.

Measurement of stand density is a very useful tool to predict present or future susceptibility of a stand to drought-related or insect-caused mortality. The stand density index (SDI) is a quantitative measurement that takes into account number of trees and total basal area of a stand, and equates them to a standardized numeric value, or stand density index. This numeric value can be used to compare different stands and different treatments.

The density of a stand is ultimately limited by resources such as soil moisture and growing space. Research has shown that when a stand approaches 60 percent of the stand’s maximum stand density index, the inter-tree competition for resources and the risk of mortality from insect, disease, and drought begin to increase (Oliver 1995; Simonson 1998; Cochran et al. 1994). All stands are continually growing

[1] SDI or stand density index, is a measure of the stocking density of a stand of trees based on the number of trees per unit area and average diameter of the trees. Forests at 60% maximum stand density (SDI max) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to drought

and moving toward a maximum stand density index. Maximum stand density index reflects full "biological" occupancy of the site, where growing space is fully utilized. Exceeding this level will create mortality and self-thinning due to over-utilization. At this stage individual tree and stand growth is low, and eventually individual tree mortality offsets growth to keep the stand near or at maximum stand density index. Historically, fire was a primary event that naturally thinned stands and kept most from reaching that limit. That natural control of stand density was curtailed with the advent of fire suppression in the early 1900s in the Lassen National Forest.

Most stands proposed for thinning have stand density indices ranging from 50 percent to over 80 percent of maximum stand density index. Approximately 65 percent of the California Wildlife Habitat Relationship (CWHR) density class M and D stands proposed for thinning are at or above 60 percent of maximum stand density index. Stands proposed for treatment that are at 50 percent or less of maximum stand density index still have undesirably dense surface and ladder fuels, as well as scattered dense pockets of trees that would contribute to fire intensities and are undesirable in terms of fuels and fire behavior.

Measurement Indicators Used in the Analysis for this Objective.

- tree species composition
- stand density index
- stand structure

Objective 2-Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

One of the management tools in the HFQLG Act provided to accomplish fuels reduction and provide a safe haven for firefighters is a network of Defensible Fuel Profile Zones (DFPZs). A DFPZ is a strategically located strip of land approximately ½ mile wide on which fuels, both living and dead, have been modified in order to reduce the potential for sustained crown fire and flame length. The main purpose of a DFPZ is to reduce wildfire intensity and rate of spread and to provide fire suppression personnel a safer and more effective location from which to take action.

Current fuels conditions in the Creeks II project area make firefighting difficult. Heavy fuels and dense timber stands increase flame lengths, slow fire line construction, and limit strategic control points which are important for efficient wildfire control and firefighter safety. The Creeks II project proposes creating strategically located DFPZs to implement HFQLG Act direction and to tie to the network of DFPZs already in place on public and private lands. Specific criteria for DFPZs are included in appendix J of the HFQLG FEIS.

Create DFPZs to:

a. create a safe location for fire-fighting personnel to conduct fire-suppression activities by reducing predicted flame length to less than 4 feet and reducing fuel loads to less than 5 tons per acre of material less than 3 inches in diameter and less than 10 tons per acre of material 3 inches and greater in diameter.

b. Reduce the potential for crown fire (fire in the tree canopy) both within and outside of DFPZs by increasing average canopy base heights to approximately 20 feet. This would reduce the number of entries required to meet and maintain effectiveness of DFPZs for approximately 20 years.

c. connect to an existing DFPZ network.

Need

Fire is a natural part of ecosystem processes, but the years of fire suppression efforts and past management practices have changed the fire regime and contributed to the dense stands in the Creeks II project area. The fire return interval discussed in the background section is a reflection of this change and, as also noted, earlier fires were generally of a limited intensity. Even when stand replacing fires did occur, they were limited in size (generally to less than 100 acres) by the lack of continuous fuels.

Recent wildfires in the Plumas and Lassen National Forests, as well as elsewhere, have clearly shown that to protect present-day resources, fire suppression must continue. While the case may be made for restoring fire to the ecosystem, the stands in the Creeks II project area are too dense to safely burn without substantial risk to resources such as habitat, soils, and watersheds. If there is to be movement toward improved forest health and restoration of historical ecosystem processes in the Creeks II area, management practices should include fuels management and correction of stand densities to protect the project area and surrounding areas from the potential for stand-replacing fires that accompany the present dense stand conditions.

Ladder fuels are small trees, brush, and other living or dead material that can serve as a bridge or ladder of flammable material allowing fire to travel from surface fuels up into overstory canopy fuels. Surface fuels are vegetative materials near the ground through which fire will spread. Existing conditions in the Creeks II project area include moderate to high, coarse, woody fuel loads, with small surface fuels (0-3 inches diameter) ranging from 5-10 tons/acre. For a DFPZ to be effective, fuel loads should not exceed on average 5 tons per acre of coarse down woody material in the 0-3 inch diameter range (HFQLG FEIS appendix J). In addition, no more than 10-15 tons per acre of coarse down woody material in excess of 12 inches in diameter should remain in order to meet DFPZ standards (HFQLG FEIS appendix J).

The existing surface and ladder fuels combined with a 4 to 8 feet average canopy base height (the average height to the bottom of live crown) of stands in the project area increase the risk that fire could be transferred into the crown, thereby increasing the probability of a sustained crown fire and unsafe conditions for fire suppression efforts. The desirable canopy base height is 20 feet to limit the ability of fire to travel to the live crown of a tree. Due to high fuel loads in the project area, the predicted flame lengths in many areas are in excess of 4 feet. Flame length is used to represent potential fireline intensity which indicates how hard a wildfire is to suppress. Flame lengths less than 4 feet are desired to allow for safe direct attack by hand crews. Conversely, flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft.

Measurement Indicators Used in the Analysis for this Objective.

- predicted flame length (measured in feet)
- fire type (surface, passive crown or active crown)
- fuel loading (measured in tons per acre)
- Canopy base height.

Objective 3-Implement economically efficient treatments to reduce hazardous fuels and contribute to community stability.

Congress has directed the Forest Service to implement proposed treatments and to do so in a cost-effective manner. The HFQLG Act also directs that the required final report on the entire pilot project include whether and to what extent the pilot project has improved both ecological health and community stability. The forest products industry provides jobs and revenues for rural communities.

The Creeks II project would contribute to community stability by providing employment for contractors and personnel involved in the removal of wood byproducts and for employees in wood manufacturing and energy production plants. The project would also provide a wood supply for local manufacturers who rely on federal timber to keep local mills in operation.

Need

There are several communities within reasonable haul distance from the project area. Factors influencing the economies of Butte and Plumas counties include isolation from urban job markets, reliance on natural resource based industries, and high seasonal fluctuations in employment. Timely timber sales in Butte and Plumas counties contribute to a proportional supply of timber and revenue to local communities. Funds derived through the sale of timber help offset costs associated with fuels reduction and forest health treatments. Without use of timber value, implementation of project treatments would rely entirely on appropriated funding. Appropriated funds can vary substantially on a yearly basis. Economically efficient fuels and forest health treatment projects reduce or eliminate the need for appropriated funding to implement the projects.

Measurement Indicators Used in the Analysis for this Objective.

- revenues and costs associated with management activities
- jobs and income created by the Creeks II project

Objective 4-Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.

Provide future late seral habitat as replacement habitat if current, untreated areas of habitat (such as California spotted owl and goshawk protected activity centers) are affected by fire or disease.

Forest Plan direction states the following relevant direction: provide vegetative diversity to maintain scenic quality, viable populations of plants and wildlife, and to minimize loss from wildfire (A-20). Provide sufficient habitat for species dependent on snags (E).

Need

This objective addresses the need to provide a comprehensive approach to maintaining existing and future late-seral habitat throughout the project area while addressing forest health issues. Treatments would be designed to retain and promote habitat connectivity and stand heterogeneity for late seral species such as the California spotted owl and the American marten.

Measurement Indicators Used in the Analysis for this Objective.

- change in tree species composition and stand density
- amount of pine in the project area
- large tree and habitat attributes important to late-seral species – number of trees over 24 inches d.b.h., and canopy cover exceeding 40 percent

Objective 5-Increase heterogeneity and diversity within size class 4 stands.

The Creeks II project group selections are designed to contribute to goals of the 1998 HFQLG Act while meeting requirements of the amended Forest Plan. Project design is intended to contribute to the group selection acreage goals identified in the pilot project, consistent with protection of ecosystems, watersheds, and other forest resources, good silvicultural practices, and economic efficiency.

A group selection is an area 1/4 to 2 acres that is cleared of trees. This area creates an opening in the forest canopy that allows for the establishment of a more diverse community of plants, from the reintroduction of brush to the regeneration of pine species. Group selections are intended to create all-age, multi-storied stand conditions that are currently lacking across the landscape, maintain a relatively continuous forest cover, employ rotation ages that vary by timber site quality, and promote an adequate timber supply and local economic stability.

Group selections provide conditions for the regeneration and growth of more fire tolerant pine species that otherwise do not grow well in a shaded environment underneath an overstory. Group selections provide recruitment of future overstory pine, and provide structural diversity by creating small patches of vegetation and young trees interspersed in stands of larger trees. When viewed from the landscape level, a multi-storied effect would be achieved.

Need

The 1998 HFQLG Act requires that the effectiveness of group selection be demonstrated in achieving an all-age, multistory, fire-resilient forest and calls for the Forest Service to carry out group selection treatments over an average of 0.57 percent of the pilot project land area each year (or 5.7 percent each decade), using the most cost-effective means available. Group selection is additionally used to promote local economic stability, maintain a relatively continuous forest cover, and create forest conditions that closely mimic the historical natural landscapes of the Sierra Nevada range.

Currently, many stands are predominantly single-aged, averaging 90 – 120 years old, CWHR size class 4 (12 to 24 inch d.b.h.), with scattered older remnant trees in some places. Species composition in these stands, particularly the mixed-conifer forest type, has shifted over time to become increasingly dominated by shade-tolerant white fir.

Pine seedlings do not grow well shaded beneath an overstory and generally die off unless some disturbance creates gaps in the overstory. To increase the percentage of pine, and diversify overall species composition and age class, either openings or areas of low canopy densities are needed to allow pine to grow.

Measurement Indicators Used in the Analysis for this Objective.

- tree species composition
- stand structure
- age class distribution within the project area

Objective 6-Promote the health of aspen stands

Restore the proper growth environment for aspen by removing competing conifers and protecting regeneration from browsing. Lassen Forest Plan provides direction to achieve the desired future conditions for vegetation diversity in aspen stands.

Need

Surveys in the Creeks II project area identified the presence of conifer encroachment, excessive browsing, and other risk factors preventing aspen from successfully regenerating. Active management is necessary to improve chances for the long-term survival of aspen communities within the Creeks II project area.

In some cases, wildland fire would be a viable means to promote vegetative reproduction. However, existing stand conditions and any risk factors present must be taken into account when determining the appropriate treatment for hormonal stimulation (Jones et al. 2005). In the case of the Creeks II project, encroachment of conifers on the aspen clones is extensive enough that damage to the aspen stands and death of the roots, which lie very close to the ground surface, would result if a fire would occur. Related studies, including Jones et al. 2005, have shown that removing conifers via hand thinning and conventional timber harvest is effective in stimulating the hormones and providing the proper growth environment.

Aspen communities in California's Sierra Nevada range are ecologically significant for their biodiversity and geographic rarity. Healthy aspen communities support a diverse suite of animal and plant species through the ecosystem services they supply. Aspen communities provide important structural attributes in the overstory that support cavity nesting birds like the red-breasted sapsucker, tree swallow, and mountain blue bird. The diversity of size classes that exist in healthy aspen stands also provide structural attributes important to many wildlife species including deer, foliage gleaning birds, and a variety of small mammals. Aspen communities often support a diverse assemblage of understory plants not typically found in conifer stands. In the Sierra Nevada, aspen communities are rare on the landscape, which increases their value in what is vastly a conifer dominated ecosystem.

Measurement Indicators Used in the Analysis for this Objective.

- acres of aspen habitat effectively treated
- tree species composition in treated stands

Objective 7-Improve watershed condition

Move toward desired conditions for water quality and sediment regime by reducing sediment delivery from project area roads. Applicable

HFQLG riparian management objectives (RMOs) include:

- RMO #1: Maintain or restore water quality to a degree that provides for stable and productive riparian and aquatic ecosystems. Water quality parameters that apply to these ecosystems include timing and character of temperature, sediment, and nutrients.
- RMO#2: Maintain or restore the stream channel integrity, channel processes, and sediment regime under which the riparian and aquatic ecosystems developed. Elements of the sediment regime include the timing, volume, and character of sediment input and transport.

Need

There is a need in the Creeks II project area to reduce sediment delivery to project area streams and to eliminate unneeded roads that are sources of sediment from the transportation system. An inventory of roads within the project area was conducted. Sources of erosion and road segments needing improvement were identified. In the project area, the primary sources of sediment are road crossings and roads located near stream channels. As with road inventories from other watersheds on the Lassen National Forest including Deer, Mill, Antelope Creek Watershed Analysis (Meadowbrook Associates 1997), the inventory found that sediment production is not uniformly distributed among project area roads. Most accelerated sediment production originates from a relatively small proportion of the road system.

Recent studies have found that roads are the primary source of sediment in wildland watersheds (MacDonald and Coe 2005). In the project area, sources of accelerated sediment include road crossings, roads located near stream channels, and some roads no longer necessary for long-term management of the area. Studies (Luce and Black 1999) have also found that improved surfacing and drainage on forest roads can substantially reduce sediment delivery originating on roads.

Measurement Indicators Used in the Analysis for this Objective

- eroded sediment in tons per acre
- equivalent roaded acres (ERA)
- road density in Riparian Habitat Conservation Areas (RHCAs) in miles per acre

Objective 8-Improve Vegetative Conditions within Riparian Habitat Conservation Areas (RHCAs) to meet Riparian Management Objectives

Maintain and enhance riparian forest stand conditions that would trend towards desired conditions identified in riparian management objectives and are more resilient to disturbance such as wildfire as well as insect and disease that can occur as a result of prolonged drought conditions.

In RHCAs, all proposed management activities are limited or regulated by specific standards and guidelines, and must contribute to improving or maintaining watershed and aquatic habitat conditions as described by the eight HFQLG riparian management objectives. The riparian management objectives are included in appendix D of this EIS.

Need

RHCAs (sometimes know as streamside management zones) are land allocations that are designated adjacent to aquatic features (e.g., all ephemeral, intermittent, and perennial streams, lakes, ponds, and wetlands). The RHCAs serve the purpose of maintaining, protecting, and/or restoring riparian processes important to aquatic and riparian communities, through active and/or passive management of functional processes important to the communities associated with them.

Riparian management objectives are intended to promote conditions within RHCAs such that aquatic and terrestrial riparian habitats can maintain desired native and desired non-native plant and animal species. These conditions include large trees available for recruitment to stream channels, diversity of stand structure and species diversity, adequate stream channel cover to maintain suitable water temperatures, stable stream channel banks, and late-seral habitats.

Existing condition inventories were conducted within RHCAs located adjacent to proposed DFPZ and area thinning treatments within the Creeks II project area. In general, this data revealed that stands within RHCAs were exceptionally dense with small diameter trees less than 5 inches d.b.h., and lacked the large diameter (> 24 inches d.b.h.) component valuable for healthy riparian and aquatic resources. On average, RHCAs within the project area contain a total of 846 trees per acre. Of these approximately 82 percent were 5 inches d.b.h. or less in size. Trees larger than 20.9 inches d.b.h. comprised < 3 percent of the average trees per acre. Fuel concentrations within RHCAs were observed to be moderate to high across the project area, particularly within larger size classes (> 3 inches).

Measurement Indicators Used in the Analysis of this Objective

- change in stand density
- change in average stand diameter
- change in percent maximum stand density index (SDI)
- change in ladder and surface fuels

Proposed Action

The following is a brief summary of the proposed action developed by the ID Team. All alternatives are presented in more detail in chapter 2. This proposed action alternative was modified after being sent to the public for scoping. The modifications are detailed in Table 3. Throughout the development of the proposed action and the collaborative process, the ID Team worked diligently to ground-truth and refine maps and locations of treatments, as well as search for and correct mapping errors or confusion. As a result, there were changes in the acres proposed to be treated. The modified proposed action reflects these efforts.

Included in this proposal are the construction and maintenance of National Forest System roads, the use of temporary roads, and the decommissioning of system and temporary roads. These management activities were developed to implement and be consistent with the 1993 Lassen Forest Plan, as amended and the SNFPA ROD (2004). A road analysis for the project area concluded that some roads in the project area are not needed for future management. As per the Lassen Forest Plan direction, these roads would be removed from the transportation system (decommissioned).

Table 3. Changes from the original proposed action to the updated proposed action

Treatment Category	Treatment	Proposed Action as Mailed	Updated Proposed Action	Change
DFPZ	A	3057	2995	-62
DFPZ	B	65	94	+29
DFPZ	C	361	178	-183
DFPZ	O	609	683	+74
Area Thin	D	1900	1406	-494
Area Thin	E	1103	1765	+662
Group Selection	GS	708	640	-68
Aspen Enhancement	F	688	299	-389
RHCA		400	combined into treatment areas above	
Total Acres All Treatments		**8891**	**8060**	

Decision Framework

Given the purpose and need, the deciding official reviews the proposed action, the other alternatives, and the environmental consequences in order to make the following decisions:

The decision to be made is whether to: 1) implement the proposed action, 2) meet the purpose and need for action through some other combination of activities, or 3) take no action at this time.

A decision on DFPZ maintenance would not be made at this time. Treatments of stand structures are designed to be effective for a minimum of ten years, with a desired target efficacy of approximately 20 years. Some stands or portions of stands could require maintenance within ten years of the initial treatment, but there are no proposals for maintenance at this time, and any future maintenance will depend on future site conditions, funding, and other factors that are uncertain at this time. Maintenance treatments of surface fuels would not be expected to be necessary for the first five years following the initial treatment. Therefore, DFPZ maintenance would not be analyzed as a reasonably foreseeable action during the analysis of this project.

Public Involvement

A public meeting was held at the Almanor Ranger District on February 28, 2008, to introduce new projects and involve people interested in collaborating in the development of these projects. This open house format introduced five proposed projects, one of which was the Creeks II project (Creeks II).

A Notice of Intent (NOI) for the Creeks II project was published in the Federal Register on May 19, 2008, and scoping began on May 20, 2008. During the scoping period, District personnel presented the Creeks II project to the Butte County Fire Safe Council at their regularly scheduled meeting (June 4, 2008).

Eleven letters were received during public scoping and reflect the wide range of what were sometimes conflicting comments and concerns. The ID team reviewed the comments and attempted to develop a single alternative that would meet project objectives and the variety of concerns and suggestions brought forth in the comments.

In mid-August, 2008, the ID team met with the Lassen Forest Supervisor, to discuss the scoping comments and to determine if there was another viable alternative to bring into analysis for the Creeks II project. The requirement under HFRA to limit the alternatives brought into detailed analysis made it difficult to respond to all suggestions. The Forest Supervisor made the decision to request that interested parties join in a discussion of the project that would include face-to-face meetings and provide the opportunity work side-by-side to influence the design of any additional alternative to be analyzed.

Collaboration

The invitation to participate in the Creeks II collaboration was extended to all interested parties and began with a letter sent to those who had responded with scoping comments, as well as those who had provided written or verbal comments at the various meetings prior to scoping. The first meeting took place at the Almanor Ranger District on September 29, 2008. Sixteen people were able to attend that meeting which provided the basis for further discussion and produced requests for additional information to further the collaborative efforts.

Though face-to-face meetings through the fall were postponed or cancelled due to weather, conference calls and requests for further information continued. The responses and information were provided to all the participants and interested parties through mail and electronic media.

A second collaborative meeting was held at the Almanor Ranger District in February, 2009, and 18 people (including ID team members) were able to attend. Notes and comments provided as pre-work for this meeting reflected the dialogue that continued through the fall and acknowledged the changes that were proposed for project in response to the collaborative efforts. This dialogue continued through the spring and early summer with conference calls, meetings, and the provision of additional items that the ID team was requested to consider in alternative development.

On Tuesday, July 14, 2009, a public collaboration field trip took place. Twelve packets of initial information were mailed. Following a newspaper announcement and through word-of-mouth, a group of 26 people, including both interested individuals and Forest Service personnel, met together and visited the proposed Creeks II project area. Five stops within the project area were originally planned around earlier discussions and concerns, and recommendations from participants in the collaboration. The group was able to spend time at four of them: high quality marten habitat, marginal marten habitat, north-facing mixed-conifer (“Polygon 225”), and an area south of Soldier Meadows.

This field trip provided the opportunity for discussion while viewing the stands and resources in question and allowed the participants to use examples to clarify their discussion. Some of the suggestions would have been difficult to understand without having examples at hand to supplement the description. Among these was the concept of applying marking guidelines that would retain trees of varying size that are the most vigorous and healthy, as determined by the amount of live crown of the tree (live crown ratio). The group also discussed the addition of small (one-quarter to one-half acre) group selection units to introduce small openings. Applying both of these principles within areas of potential marten habitat could move stands closer to replicating the stand structure in the area of the group's first stop (high quality marten habitat).

The second stop built upon this initial discussion and focused on a proposed DFPZ within an area that is currently marginal marten habitat. The group discussed how it might be possible to create an effective DFPZ and still provide for a diversity of stand structure. Including areas of no or only light treatment (leave islands) placed through the stand could consider fire fighter safety and the ability to fight fire, but minimize the homogeneity of stands and the tendency to "see clear through" them.

The third stop, the north-facing slope, provided an opportunity to describe the need for site-specific treatments accommodating slope, aspect, and species composition within stands, as well as the potential to include areas of no or light treatment to contribute to potential furbearer habitat and habitat connectivity. The discussion at this stop also highlighted the differences in interpretation of data and current research in marten habitat attributes, availability, and connectivity.

Throughout project development, group selection units have been an area of concern and disagreement over attributes such as size, location, and number, and reason for their use. At the fourth stop, the group engaged in a discussion over the purpose of group selections and where group selection might be effective from differing perspectives. The participants agreed that the stand at this stop was not an appropriate location for a group selection unit because it contains a pine component and the multi-storied stand structure that they would like to see as a greater portion of the proposed project outside of the predominantly red fir area.

The final meeting of the collaborative group took place on October 23, 2009, at the Lassen National Forest Supervisor's Office, in Susanville, California. There were 14 participants: 12 were able to attend the face-to-face meeting and two participated through teleconferencing. The team began by responding to the letter from Sierra Forest Legacy dated October 21, 2009, in which they had questions about treatment M and how it is to differ from the DFPZ treatment A and an explanation of the process of reviewing the proposed group selection units and placement. There was also discussion of socio-economic impacts and the need to retain high habitat quality. Lassen National Forest Supervisor closed the meeting by thanking everyone for all the time and discussion they committed to the project, and expressed her belief that their involvement has contributed to a better project. The Forest Supervisor determined that the additional alternative would be brought forward (as alternative 3) for analysis.

Tribal Involvement

Consultation and Coordination with Indian Tribal Governments, Executive Order 13175 of November 6, 2000.

The Lassen National Forest has developed consultation protocol agreements with tribes with interests in the area. During the planning process for the Creeks II project, only the Greenville Rancheria expressed interest in formal consultation meetings with the Forest Service. At a meeting held with the Greenville Rancheria Tribal Council during August of 2006 regarding the Creeks Forest Health Recovery Project, the Tribal Chair requested that the Almanor Ranger District Staff work with Michael DeSpain, the Tribal Environmental Coordinator.

The Creeks II project consultation and coordination with tribal governments began in a letter dated May 15, 2008. This letter notified the Tribes of the proposed action and requested scoping comments. Twelve letters were mailed to five Tribes: Susanville Indian Rancheria, Mechoopda Indian Tribe of Chico Rancheria, Redding Rancheria, Pit River Tribe, and the Greenville Indian Rancheria. Comments were received from Stacy Dixon, Chairman, Susanville Indian Rancheria, and Michael D. DeSpain, Environmental Coordinator, Greenville Indian Rancheria. Chairman Dixon expressed his Tribe's support of the project and belief that the project should move forward.

In his comments, Mr. DeSpain asked that appropriate care be taken to preserve watersheds and protect Native American Archaeological or Cultural Sites within the proposed project area and offered his assistance during the planning process. Subsequent to his scoping comments, the Almanor Ranger District staff met with Mr. DeSpain during June of 2008 to discuss the proposed Creeks II project. At the close of this meeting, Mr. DeSpain expressed his support of the project and advised the staff that communication by letter would be sufficient in the future.

Issues

Comments which define a cause-effect relationship between the proposed action and its environmental effects are called issues. Such cause-effect statements provide a way to understand and focus on the issues relevant to a particular decision. Issues often describe unwanted potential effects which can be mitigated by modifying the proposed action or developing project design features to address specific concerns. They provide an opportunity during analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Unresolved issues, as such, may be addressed in the environmental analysis by developing new issue-specific indicators, or by developing alternatives to the proposed action. New alternatives must meet the project's purpose and need and be consistent with existing law, regulation, and policy.

Not all comments are issues. Comments which are not addressed as above are generally:

- suggestions for actions or analysis beyond the scope of the stated purpose and need;
- not directly related to the proposed action;
- general comments of support or information;
- already incorporated in the analysis plan;
- already decided by higher law, regulation, or policy; or,
- Conjectural in nature and not supported by scientific evidence.

The proposed action for the Creeks II project generated eleven scoping letters, including nine letters with scoping comments. In the Creeks II project, some issues (listed below) were addressed through design features incorporated into action alternatives, including alternative 3. Design features (see appendix A) were developed to reduce or eliminate potential unwanted effects.

Issues Addressed with Design Features Incorporated into Action Alternatives

Effects to Wildlife

Respondents believe that the proposed action could have adverse effects to habitat for California spotted owls, Northern goshawks, and American marten. In particular, respondents expressed concern that implementation of DFPZ treatments in red fir would degrade important habitat attributes.

Modification: A new treatment (treatment M) was designed and included in alternative 3. This treatment would be applied to stands within red fir that have a California Wildlife Habitat Relationship (CWHR) value of 4M or 4D. Treatment M would meet DFPZ objectives, but focus on long term improvement in marten habitat within the Creeks II project area.

In general, marking prescriptions will be written to retain healthy, vigorous trees of varying size classes and that have a live crown ratio of 50 percent or greater. Ten to 15 tons per acre of large down woody material would be retained where it is available.

Group Selection Units

Group selection units were addressed by several respondents, but their concerns were not the same. Some respondents expressed concern that too few group selection units are included within the project area. Other respondents expressed concern over too many group selection units and the locations of proposed group selection units.

Modification: Proposed group selection units were revisited and ground-truthed. In alternative 2, the modified proposed action, the number of group selection acres was reduced and the location of group selection units was changed.

Based on collaborative discussions, alternative 3 increased the number of group selection acres and changed additional group selection locations to further reflect the intention to enhance stand structure and heterogeneity, and pine restoration. One-quarter to one-half acre group selection units were added within the treatment M units and placed adjacent to existing openings to improve or maintain habitat for marten and their prey base.

In both alternatives, group selection units are avoided within owl territories, except where they meet objectives for owl habitat and where the territory contains more than 50 percent suitable habitat.

Leave (Untreated) Islands within DFPZ Units

Discussions during collaboration meetings and field trips included concerns that treatment A DFPZ units retain little or no understory structure and that it is possible to “see right through them”. This lack of diversity seemed to be counter to a desire for heterogeneity within the project area. Leave islands were included in the design of DFPZ treatments C and O to provide a more heterogeneous structure.

Modification: The continuing collaboration dialogue and site-specific examples during field review provided an opportunity to better describe the attributes included in proposed DFPZ treatments within potential marten habitat. Prescription M includes the leave islands scattered through the unit while still meeting the objectives of a DFPZ for fire fighter safety and space for the fire to be brought to the ground.

Laws, Regulations, and Policies

All resource management activities described and proposed in this document would be implemented to the extent they are consistent with applicable Federal law, United States Department of Agriculture (USDA) regulations, and Forest Service Policies.

Civil Rights Impact Analysis (USDA Regulation 4300-4)

A Civil Rights Impact Analysis was completed for the HFQLG FEIS (appendix O). Three categories were analyzed: (1) work force characteristics, (2) attitudes/beliefs/values, and (3) civil rights. Favorable impacts, unfavorable impacts, and mitigations were identified for each of the three categories.

Clean Water Act (Public Law 92-500)

All Federal agencies must comply with the provisions of the Clean Water Act. The Clean Water Act regulates forest management activities near federal waters and riparian areas. The proposed action meets the terms of the Clean Water Act for non-point sources of pollution, primarily pollution caused by erosion and sedimentation. As described in the 1999 HFQLG FEIS, compliance with the Clean Water Act is accomplished through implementation of Best Management Practices (BMPs) for National Forests in California (USDA Forest Service 2000f).

The State and Regional Water Quality Control Boards entered into agreements with the Forest Service to control nonpoint source discharges by implementing control actions certified by the State Water Quality Control Board and the EPA as BMPs. BMPs are designed to protect and maintain water quality and prevent adverse effects to beneficial uses both on-site and downstream. In addition, the land disturbing activities described in the proposed action would be dispersed in time and space so that the subwatersheds would not reach or exceed the threshold of concern for overall watershed disturbance.

Clean Air Act (Public Law 84-159)

Forest Service managers would follow specified provisions for smoke management whenever fire is prescribed for pile and understory burning. The following documents provide Forest Service managers with the guidance and direction for smoke management to protect air quality: (1) Interim Air Quality Policy on Wildland and Prescribed Fires, issued by the Environmental Protection Agency in 1998; (2) Memorandum of Understanding between the California Air Resources Board (CARB) and the USDA Forest Service, signed on July 13, 1999; and (3) Smoke Management Guidelines in Title 17 of the Code of California Regulations.

The project area lies within the Plumas and Butte County Air Pollution Control Districts (ACPD). As a matter of regional policy (Smoke Management Guidelines in Title 17 of the California Code of Regulation), a smoke management plan would be submitted to and approved by involved agencies prior to any burning that would occur within the Creeks II project area. Several communities lie within proximity of the areas where both pile and prescribed burning is proposed to occur. Adherence to the smoke management plan for pile and understory burning would alleviate negative impacts to communities. By adhering to a smoke management plan approved by the Lassen National Forest Supervisor and the Northern Sierra Air Quality Management District, particulate matter emissions from pile or understory burning would not violate California Ambient Air Quality (CAAQ) emission standards. Short duration production of smoke and associated emissions would occur during pile and understory burning.

Endangered Species Act of 1973 (Public Law 93-205)

Section VII of the Endangered Species Act requires Federal agencies to consult with the United States Department of the Interior Fish and Wildlife Service (Fish and Wildlife Service) and/or the United States Department of Commerce National Marine Fisheries Service (NMFS), whichever is appropriate, during project planning when threatened or endangered species, or their associated critical habitat, may be affected by a project.

Wildlife Consultation

A list of threatened and endangered species proposed for listing under the Endangered Species Act was obtained from the Fish and Wildlife Service on April 29, 2010. A review of that list, survey records, and the habitat found within the project area indicated that federally listed terrestrial species are absent from the project area. Therefore no consultation with Fish and Wildlife Service was initiated.

Fisheries Consultation

A list of threatened and endangered species under the Endangered Species Act was obtained from the National Marine Fisheries Service (NMFS). A review of that list, survey records, and the habitat that is found within the project area indicated that federally listed aquatic species are absent from the project area. Therefore no consultation with NMFS was initiated. As stated in the Record of Decision for the Herger-Feinstein Quincy Library Group Forest Recovery Act where project areas include lands below 5,500 feet within the Central Valley hydrologic units, a habitat assessment for California Red-legged frogs must be completed with subsequent review by the Fish and Wildlife Service. A habitat assessment was completed for the Creeks Forest Recovery Project in January, 2005, and received by the Sacramento Fish and Wildlife Service office on January 20, 2005, for their review. In summary, their review letter received by the Lassen National Forest on February 5, 2005, concluded that the sufficient surveys had been conducted within the Creeks Forest Recovery Project area for the California red-legged frog.

Botany Consultation

A list of threatened and endangered species proposed for listing under the Endangered Species Act was obtained from the USDI Fish and Wildlife Service (Fish and Wildlife Service) on October 12, 2010. A review of that list, survey records, and the habitat found within the project area indicated that federally listed plant species are absent from the project area. Therefore no consultation with Fish and Wildlife Service was initiated.

Federal Insecticide, Fungicide, and Rodenticide Act (7 USC 136 as amended)

The Federal Insecticide, Fungicide, and Rodenticide Act, as amended (7 U.S.C. 136), is the authority for the: registration, distribution, sale, shipment, receipt, and use of pesticides (collective for insecticides, fungicides, and rodenticides). The Forest Service may use only pesticides registered or otherwise permitted in accordance with this act. In addition, the Forest Service in Region 5 must comply with California State laws and regulations regarding pesticides. Also, Forest Service policy in Region 5 is to only use EPA and California-registered pesticides. The action alternatives include the use of an EPA registered borate compound on cut stumps that are 14 inches diameter and greater for the prevention of annosus root disease. The borate compound is considered a fungicide.

Herger-Feinstein Quincy Library Group Forest Recovery Act of 1998 (Title IV, Section 401)

Forest Supervisors for the Plumas, Lassen, and Tahoe National Forests signed a ROD for the HFQLG FEIS in August 1999. The ROD amended the three Forest Plans to establish a pilot project to demonstrate and test the effectiveness of management activities described in the HFQLG Act of October 21, 1998. The Creeks II project incorporates all of the elements of that decision, including the Forest Plan amendments.

Migratory Bird Treaty Act of 1918 as amended (16 USC 703-712)

The original 1918 statute implemented the 1916 Convention between the United States and Great Britain (for Canada) for the protection of migratory birds. Later amendments implemented treaties between the United States and Mexico, Japan, and Russia. Specific provisions in the statute include the establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds or any part, nest, or egg of any such bird." Because forestlands provide a substantial portion of breeding habitat, land management activities within the Lassen National Forest can have an impact on local populations.

National Forest Management Act of 1976 (NFMA; Public Law 94-588)

The National Forest System lands affected by the Creeks II project are subject to management direction in the 1993 Lassen Forest Plan, as amended by the 1999 HFQLG ROD and the 2004 SNFPA ROD. The Forest Plan as amended provides management guidance for all National Forest System lands and resources within the Creeks II project area. It includes direction for forest management, goals and objectives, standards and guidelines, area management direction, and the anticipated outputs of forest products.

The Forest Plan, as amended, has been reviewed in consideration of the Creeks II project. This project is responsive to guiding direction contained in the Forest Plan, is consistent with the standards and guidelines contained in the Forest Plan, and is consistent with the requirements for management treatments.

National Historic Preservation Act (Public Law 89-665)

The proposed action is in conformance with regulations of the National Historic Preservation Act (NHPA), 1966, as amended (P.L. 89-665, 80 Stat.915); the National Environmental Protection Act (1969), Archaeological Resources Protection Act of 1979 (ARPA), Native American Grave Protection and Repatriation Act (1990: P.L. 101-601), and American Indian Religious Freedom Act (1978: P.L. 95-341), and as called for by the 1996 First Amended Regional Programmatic Agreement Among The USDA Forest Service, Pacific Southwest Region California State Historic Preservation Officer, And Advisory Council On Historic Preservation Regarding The Process For Compliance With Section 106 Of The National Historic Preservation Act For Undertakings On The National Forests Of The Pacific Southwest Region (Regional PA), and the 2004 Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects (Interim Protocol).

Wild and Scenic Rivers Act (Public Law 90-542, as amended)

The proposed action is consistent with provisions of the Wild and Scenic Rivers Act, which regulates forest management activities within the National Wild and Scenic Rivers System. There are no wild and scenic rivers within the Creeks II project area.

Healthy Forest Restoration Act (HFRA)

The Healthy Forest Restoration Act (Healthy Forests Initiative 2002; Healthy Forests Restoration Act 2003) directs agency personnel to improve forest conditions through fuels reduction activities. The Healthy Forest Initiative provides administrative reform to aid in accomplishing this task.

Environmental Justice Act

Executive Order 1289 on Environmental Justice requires all federal agencies to identify and consider disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority, or low-income populations. The proposed actions were analyzed in the 1999 HFQLG FEIS in relation to potentially adverse environmental, health, social, or economic effects on low-income or minority populations.

Figure 3 highlights demographic statistics for identifying potential communities of concern. There are no communities near the Creeks Project area with significant low-income or minority populations. Therefore, specific actions to address environmental justice concerns were not implemented for this project.

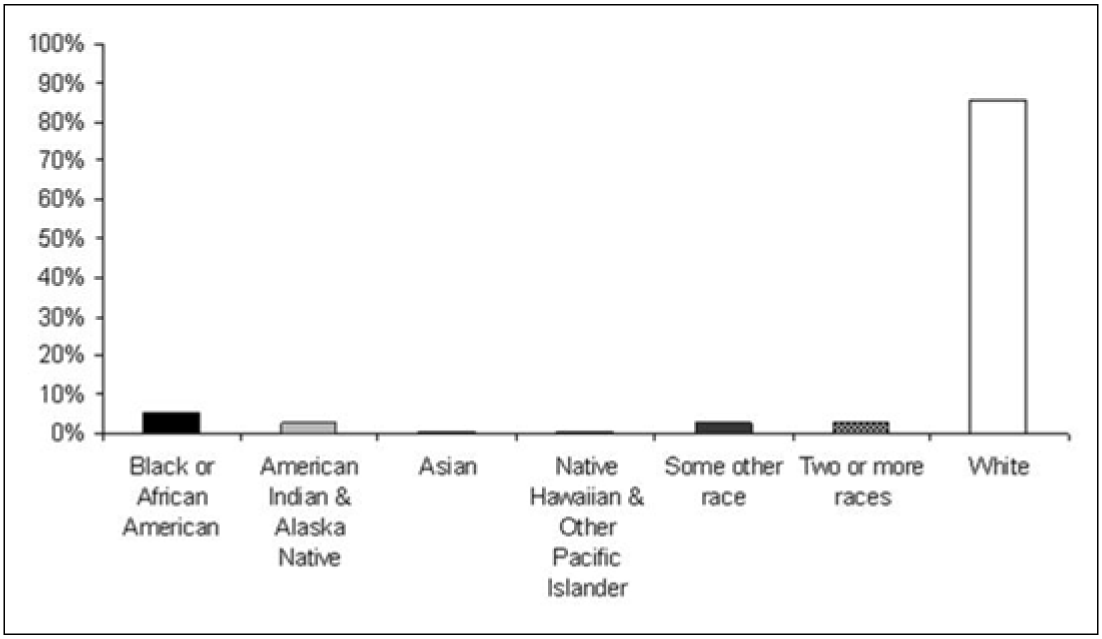


Figure 3. Population by race for Lassen, Plumas, and Sierra Counties

Permits and Coordination

The Forest Service coordinates its activities with Federal, County, and State of California regulatory agencies, including air quality management districts, and water quality control boards. Permits would be required from the air quality management districts prior to prescribed burning. Conditional waivers of the requirement to file a report of waste discharge for timber harvest activities on National Forest lands would be required from the appropriate water quality control boards.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the Creek s II Project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative, and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

Alternatives Considered in Detail

The Forest Service developed four alternatives, including Alternative 1 - No-action, Alternative 2 - Modified Proposed Action, Alternative 3 and Alternative 4.

Alternative 1-No-action

Under the no-action alternative, current management plans would continue to guide management of the project area. No treatment activities would be implemented to accomplish project objectives. The no-action alternative provides a baseline for comparative analysis of the action alternatives. Although there would be no action to treat vegetation under this project, other activities in the Creeks II project area such as road maintenance, fire suppression, firewood cutting, grazing, hunting, and OHV riding would continue.

Features Common to Alternatives 2-4

Integrated design features (IDFs) are elements of the project design that are applied in treatment areas in addition to direction provided through the Forest Plan as amended or through other applicable laws and policy. The integrated design features were developed to reduce or avoid adverse environmental effects of the proposed action and other action alternatives to forest resources. These important features are incorporated into all the action alternatives, where applicable and are listed and described in detail in appendix A.

Alternative 2- Modified Proposed Action

This alternative was created to respond to the purpose and need for this project.

Proposed Treatments

Included in this proposal are vegetation management, construction and maintenance of National Forest System roads, use of temporary roads, and decommissioning of system and temporary roads. These management activities were developed to implement and be consistent with the 1993 Lassen Forest Plan, as amended by the HFQLG Forest Recovery Act ROD (1999, 2003) and the SNFPA ROD (2004).

Treatment activities for alternative 2 are summarized in the tables and discussion below. See Map 2 for specific locations of treatments. Detailed descriptions of each treatment are located in appendix C.

Vegetation Management

Table 4. Vegetation treatments proposed for alternative 2

Treatment Category	Treatment[a]	Total Acres[b]	Acres within RHCAs
DFPZ	A	2995	167
	B	94	13
	C	178	0
	O	683	125
Area Thin	D	1406	18
	E	1765	57
Group Selection	GS	640	0
Aspen Enhancement	F	299	154
Total of all vegetation treatments		8060	534

a - Detailed descriptions of each treatment are located in appendix C.
b- Acres include treatments within RHCAs

Defensible Fuel Profile Zones (DFPZ)

Under all DFPZ treatments, trees would be thinned using a modified "thin from below" technique which emphasizes removing the smaller trees and leaving the larger, healthier trees. To enhance stand heterogeneity, "thin from below" would be modified to focus the removal of trees from a variety of size classes in proportion with their occurrence in the stand. This treatment would leave a complex stand structure with a reduced potential for fire to carry through the treatment area. Small understory conifer trees would be thinned where they could serve as ladder fuels to adjacent overstory trees. Mid- and upper-story trees would be removed to protect adjacent "leave" trees and to break up canopy fuel continuity.

Treatments A-O are all DFPZ treatments, but residual densities vary by habitat objectives in those areas. See Map 2 in appendix B. This project incorporates a number of approaches to meet the objectives to retain and enhance habitat elements (e.g., habitat connectivity and stand heterogeneity) for late-seral wildlife species. The approach in this proposed action is based on utilizing modified thinning treatment elements to address short- and long-term habitat needs specifically for the California spotted owl and American marten. The elements for treatments B, C, and O are specifically designed to retain or improve future habitat conditions for species that prefer late-seral habitat, while still meeting fuels objectives.

Canopy cover within the individual treatment units would generally average between 30– 50 percent depending on the canopy cover prior to treatment and the spatial arrangement of the fuels and vegetation. Overstory trees would be variably spaced across the landscape, from small tightly-spaced groups of several overstory trees to more widely-spaced individual trees. Overall tree canopy continuity would be broken up to minimize the potential of a continuous crown fire. Small diameter conifers (6-inch d.b.h. or less) would be few and scattered throughout the stands, approximately 50 trees per acre or less. There are a few stands that have a minor component of oak. All oaks would be retained as feasible during treatments and all larger oaks (12-inch d.b.h. or greater) would be protected during project implementation.

Trees that are suppressed, of considerably poor health, or appreciably diseased would generally be removed in favor of healthier trees. Pockets of dead and dying trees would be removed where they are in excess of the snag retention guidelines. Removing these pockets of dead and dying trees would create small openings that would be averaged with overall stocking when considering an overall canopy cover.

DFPZ locations and boundaries have been refined from those identified in the 1999 HFQLG ROD based on site-specific review by district specialists. The treatments in this proposal are designed to achieve DFPZ objectives as described in the 1999 HFQLG FEIS (appendix J, page 5), and comply with the standards and guides set forth in the 2004 SNFPA ROD (pages 67-68). After treatment, stands would be open and dominated by larger, fire tolerant trees where they exist. The openness of crown fuels, reduced ladder fuels, and low amounts of surface fuel would produce a lower risk of sustained crown fire. Post-treatment stands would more closely reflect a fuel condition class I as described in Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy (USDA Forest Service 2000).

Treatment A - DFPZ surface, ladder and canopy fuels

The remaining canopy cover would generally average between 30 percent - 40 percent.

In these stands treatments would focus on removing undesirable surface and ladder fuels and occasional mid- and overstory trees in dense pockets while retaining variable spacing of overstory and understory trees as described above.

Plantations would also be included in this treatment. They would be thinned to approximately 125-200 trees per acre, depending on species and tree size, to reduce fuel continuity.

Treatment B - DFPZ Surface, ladder and canopy fuels in CWHR 5M, 5D, and 6 size stands

This treatment applies to stands categorized as CWHR 5M, 5D and 6. These are stands that have a quadratic mean diameter of 24-inches or greater now and an average canopy cover of 40 percent or greater (CWHR 5M) or 60 percent or greater (CWHR 5D and 6).

This treatment would retain stand structures at the upper end of the desired range for a DFPZ. Canopy cover would be retained at approximately 40 percent - 50 percent

Emphasis would be placed on breaking up ladder and surface fuel continuity while maintaining canopy cover and stand heterogeneity.

Treatment C - DFPZs modified to provide habitat connectivity

Treatment C would be applied to areas where maintaining late-seral habitat connectivity in known marten locations is paramount. These areas are located in the red fir belt on the west side of the project area near Humbug Summit and east of Ruffa Ranch, north of Butt Creek.

Treatment C would retain a minimum of 40 percent canopy cover where it exists. Where the initial canopy cover is less than 40 percent, the canopy cover would be reduced by no more than 5 percent.

This treatment would stress not only canopy retention, but also the development of a number of attributes such as large trees, multi-layered stands, and vegetative diversity in both species and structure.

To provide structural heterogeneity within the stand, untreated "diversity islands" of approximately 1/8 acre to 2 acres in size would be left throughout the treatment units. These islands would provide a component of dense clumps of trees over approximately 25 percent of the treatment unit and would be representative of pre-treatment stand conditions. Approximately one-half the islands would receive hand treatment to reduce surface and small ladder fuels. Diversity islands would be scattered throughout treatment units, but would be placed a minimum of 100 feet away from roads to provide firefighter safety.

Treatment O - Owl foraging habitat (CWHR 4M, 4D) in areas adjacent to California spotted owl activity centers

This treatment would be used in stands composed of foraging habitat that are adjacent to California spotted owl activity centers. This treatment would also be assigned to some stands that are not suitable habitat (smaller trees and a more open character) but may have inclusions of suitable habitat or have attributes that could be developed as suitable habitat in the near future.

A key element to this treatment would be the retention of diversity islands in approximately 15 percent of the treatment area. Treatment O would alternately thin and retain diversity islands to emphasize the retention of suitable habitat characteristics immediately after treatment and reduce the risk of widespread mortality from insect and disease outbreaks, as well as reducing impacts due to wildfire

Area Thinning

Area thinning treatments would be designed to reduce surface, ladder and canopy fuels and provide complimentary support to the DFPZ network while maintaining long-term late-seral habitat features. There would be two treatments for area thinning: treatment D and treatment E. The main difference between treatments D and E is that treatment E would include those stands that currently provide suitable habitat (defined as CWHR Strata 4M, 4D, 5M, 5D, and 6) for species such as the California spotted owl and American marten.

In addition to treating fuels, the objective would be to develop stands that increase the vegetative variability of the stand, maintain suitable habitat conditions for late-seral species and increase the rate at which stands develop desired late-seral characteristics, specifically a large tree component. This would be accomplished through retaining clumps of trees (1/8 to 2 acres in size comprising approximately 15 percent of the area), radial thinning around large trees, and retaining all size classes (as opposed to simply removing all trees up to a pre-defined diameter) to ensure that the existing structural complexity is not lost. Proposed treatments would temporarily reduce canopy cover, but would retain important structural elements (snags and down logs and result in a substantially lower risk of wide-scale mortality due to insects, disease, and wildland fire.

Treatment D - Area Thinning in CWHR size classes 2 and 3 and CWHR 4S and 4P.

This treatment would apply to treatment units in CWHR size class 2 and 3, as well as sparse open stands classified as CWHR 4S and 4P. These treatment units may contain small aggregates of suitable habitat (CWHR 4M, 4D). The objectives of this treatment would be to reduce potential fire mortality by breaking up the continuity of fuels and to provide for the development of late-seral habitat.

Treatment would focus on removing the smaller midstory and understory trees that may serve as ladder fuels and removing occasional larger midstory and overstory trees (up to 30-inch d.b.h.) from dense pockets to provide crown separation and reduce fuels continuity. Average canopy cover would be retained at or above 40 percent in areas that meet suitable habitat criteria.

Radial release would be implemented around 3 to 5 large trees per acre, with a focus on retaining the largest pine in the treatment area. Radial release consists of removing all trees smaller than the selected tree (and less than 30-inch d.b.h.) for a distance from the bole in feet for a numeric conversion equal to the selected tree's diameter in inches and not to exceed 30 feet. For example, a radial release around a 26-inch d.b.h. pine would extend out for 26 feet. This treatment would provide more resources to the selected trees during times of increased stress, such as when water availability is critical. These are the trees that develop the critical habitat attributes preferred by late-seral species. When droughts or insect infestations occur, the larger trees, especially pine, tend to be susceptible to mortality, particularly when growing in dense stands. Radial release would promote the survival of the selected large trees during drought events and remove ladder and canopy fuels, providing a greater opportunity to maintain the presence of large pine on the landscape today and into the future.

Treatment E - Area thin in suitable owl habitat (CWHR 4M, 4D, 5M, 5D, and 6)

This treatment would apply to stands in CWHR types 4M, 4D, 5M, 5D, and 6 where tree growth, if not currently limited, would be limited in the near future due to competition for resources. Left untreated, density-related mortality is projected to reduce the number of trees in these stands over the next 15 years (USDA 2007). By thinning these stands, higher levels of canopy cover are more likely to survive over time because of the reduced risk of extensive insect mortality and/or fire associated with overly dense stand conditions. Retaining relatively high levels of canopy cover immediately after thinning, varying the intensity of thinning, and retaining diversity islands would all be elements of this treatment designed to retain structural diversity; break up the continuity of fuels; and, provide growing space, water and soil nutrients for the residual trees to thrive.

To achieve these conditions, this treatment would retain an average canopy cover between 40 and 50 percent. Radial release would be implemented around 3 to 5 large trees per acre as described in treatment D. Diversity islands would be retained over 15 percent of the treatment area.

RHCAs

Vegetation treatments within RCHAs (inner and outer zones) would follow the DFPZ or area thinning treatment (A, B, D, E, F, O) designated for the adjacent stands (See Map 2 in appendix B). Treatments within the inner zone of RHCAs would be implemented to ensure that riparian management objectives would be achieved, including the maintenance of sufficient stream channel cover, future large woody debris recruitment, vertical stand heterogeneity, and species diversity. Furthermore, canopy cover would range from 40 to 50 percent and no trees larger than 24 inches d.b.h. would be removed. Specific design features, best management practices and soil quality standards have been developed for activities within RHCAs and would be implemented to minimize adverse impacts to resources (see appendix A for a detailed description of integrated design features and other guidelines). For aspen treatments (treatment F) within RHCAs refer to the aspen section and integrated design features listed in appendix A.

Treatments proposed in the outer zone would provide for continuity of upslope fuel treatments in the outer zone of RHCAs to provide protection for the RHCAs and improve effectiveness of the treatments at larger scales. Treatments proposed in the inner zone would reduce high stand densities, high fuel loadings and improve species diversity.

Group Selection

Group selection treatments would be implemented to meet the objectives of increasing the pine component in areas or sites that historically contained a pine component; to add species and structural diversity to stands and sites that are lacking in diversity, usually older, thinned stands; and, to promote community stability by providing merchantable material to local mills. A group selection is an area ¼ to 2 acres that is cleared of trees. This area creates an opening in the forest canopy that allows for the establishment of a more diverse community of plants; from the reintroduction of brush to the regeneration of pine species.

Approximately 7 percent of the available and suitable land base within the project area would be treated by group selection harvest under this proposal. Using a projected 20-year re-entry period, this equates to a group selection harvest level of 0.35 percent of the available land base per year.

Treatment GS

Groups would be placed predominantly within CWHR size class 4 stands whose species composition has increasingly shifted toward white fir as a result of fire exclusion. Groups would also be placed in previously thinned (from approximately 10 to 30 years ago) stands that are predominantly white fir and lack structural diversity. The land base available and desirable for implementing group selection was determined based on land allocations, project objectives, habitat considerations, and logging feasibility. To meet the objective of maintaining spotted owl nesting habitat, groups would not be placed within CWHR size class 5 or 6 or stands that are distinctly multi-storied stands. To meet the objective of maintaining American marten habitat connectivity, groups would generally not be placed within stands in the red fir forest type. Two exceptions could be heavily diseased CWHR 4M red fir stands that are currently dying out and younger CWHR 4 red fir stands that have high crown ratios and pointed tops and that lack late-seral structure. Group selections would be proposed in these stands to begin developing the next generation of live trees.

A combination of natural regeneration and tree planting would be used to achieve a desirable species mix and seedling density (stocking). Regeneration of shade-intolerant native pine species would be emphasized in all groups.

Control of competing vegetation would be needed on all proposed group selection acres to ensure the survival and growth of desired young conifer seedlings. Vegetation control would be performed by hand grubbing or scalping of competing plants. No herbicide treatments to competing vegetation are proposed within group selections or DFPZs. Plantation performance would be monitored after the 1st and 3rd years to ensure successful regeneration within 5 years after harvest (36 CFR 219.27).

Site preparation for planting would consist of machine piling of pre-and post-harvest slash within each group selection. If deemed necessary by the district silviculturist/culturist and soil scientist, sub-soiling could be required in group selection areas prior to planting. Groups would be artificially planted with container or bare root seedlings within five years of harvest. The seedlings would be manually planted with auger or hoe. Animal control could be required after planting. Vexar tubes could be placed over planted seedlings to prevent animal browsing. Gophers could be trapped to reduce populations in planted areas.

Manual release could be required within two to five years after planting to improve survival of the planted conifers. Manual release for this purpose could include manual grubbing or mechanical release (mastication). No planned use of herbicides would be included within groups as part of conifer release for survival.

Aspen

Competing conifers may be removed through hand thinning to release aspen regeneration (approximately 100 acres). Temporary fencing would be constructed around treatment units as needed to prevent damage to young aspen sprouts from browsing animals. These activities would be paid for from KV funds derived from timber sale receipts.

Aspen occurring within DFPZ and area thinning treatments (outside of treatment F) would be protected. Ladder and canopy fuels would be thinned away from aspen. Aspen would be retained while minimizing impacts to the clones as much as practicable. No group selection harvest units or landings would be placed within aspen clones.

Treatment F

Designated conifers would be removed from the most distal aspen tree or sprout along the edge of the existing aspen clone on the south, east, and west sides of the stand out to 200 feet. On the north side of the stand, conifers would be removed within 150 feet of the most distal aspen tree or sprout. Additional conifers may be removed outside of the 200 ft buffer if they are within the designated treatment area boundary and are encroaching or overtopping other riparian hardwoods such as willows, alders, or cottonwoods.

All conifers between 3.0-inch and 29.9-inch d.b.h. would be removed, except those trees designated as leave trees or transition trees.

All conifers greater than 29.9-inch d.b.h. would be designated as leave trees regardless of species and tree characteristics.

Conifers

Cut stumps of live conifers with a 14-inch d.b.h. or greater would be treated with an EPA registered borate compound which is registered in California for the prevention of *annosus* root disease.

Post Harvest Fuels Treatments

Most of the stands and areas proposed for thinning as DFPZs or area thin in the Creeks II project area have natural surface fuel loading in excess of the desired surface fuel load of less than or equal to 15 tons/acre. When these areas are thinned, a reduction in ladder fuels would occur, but there would be a minimal impact on the existing, unacceptable surface fuel load. Table 5 lists potential treatment types and acreages, followed by treatment descriptions.

Table 5. Post harvest fuels treatments for alternative 2

Treatment	Acres
Dozer Pile/Pile Burn	2425
Dozer Pile/Pile Burn/Broadcast	2184
Grapple Pile/Pile Burn	953
Grapple Pile/Pile Burn Outside Unit (Treatment F)	23
Grapple Pile/Pile Burn/Broadcast	722
Mastication	827
No Post Harvest Activity	283
Site Prep	640
Total	8058

Mechanical treatments would be the primary method used for post-harvest fuels reduction. Mechanical treatments would entail whole tree removal and machine piling or mastication (crushing). Treatments may include mechanically chipping and removing treated fuels where economically feasible. Where removal is not possible, piles would be burned.

Hand treatments would occur in areas of light fuel concentrations where surface fuels could be safely and effectively treated on site, or where machinery is excluded for resource protection (RHCA inner zones). Hand treatments would include hand thinning, bucking, and piling surface and small ladder fuels.

Prescribed fire includes broadcast burning and pile burning. Broadcast burning involves the ignition of surface fuels over broad areas (whole forest stands) under mild fire weather conditions. The objectives of broadcast burning are to reduce surface fuel loading and to re-introduce fire into the ecosystem. Broadcast burning is proposed with alternatives 2 through 4 and would be completed only after the surface fuels are treated by mechanical piling most of the large surface fuels (3 to 12 inches diameter) and the burning of those piles (pile burning).

Road Management Activities to Improve Watershed Condition

The proposed action includes transportation actions to actively manage the forest transportation system within the project area. This would include maintenance, reconstruction, decommissioning, and construction of roads. Road related watershed improvement work would also be performed on multiple roads and drainage crossings within the project area. This work would include upgrading culverts, surfacing crossings, out-sloping sections of roadway, constructing low water crossings, and removing unneeded crossings.

Table 6. Proposed road actions in alternative 2

Action	Description	Miles
New Road Construction	Unauthorized route would be upgraded to Forest transportation standards and added as NFS roads. These routes were determined to have long-term needs for future management.	1.9
New Temporary Road Construction	New temporary road would be constructed for access during project implementation. These temporary roads would then be decommissioned upon project completion.	3.6
Decommission	Unauthorized route that was determined to have no immediate or long-term future management needs	4.6
	Existing NFS road not needed for long-term future management.	6.5
	Total	**11.1**
Reconstruct Existing NFS Road	NFS road would receive reconstruction prior to hauling	2.9
Proposed Maintenance Level 1 (+)	NFS maintenance level 2 roads would be reclassified as maintenance level 1 road once the project is complete. ML1 roads are closed to all motor vehicle traffic, but retained on the NFS to facilitate future management activities.	1.6
Use as Temporary Road then decommission*(#)*	Miles of unauthorized route are needed to access treatment units for this entry only and would be utilized as temporary roads and decommissioned upon project completion.	5.2
Decommission	OHV Trail	1.0
Road Surfacing	surface with gravel	7.3
Road Crossing Surfacing (approximate)	72 crossings	0

Alternative 3

Under the Healthy Forest Restoration Act, the decision maker on a project may chose to bring forward for further analysis an alternative that is the result of collaboration. This alternative was designed to address concerns raised during collaboration. See Chapter 1 project development and public involvement sections for details on collaborative efforts leading up to this alternative. This alternative is the agency preferred alternative.

Development of the Alternative

In the weeks following the July, 2009, field trip, the ID Team reviewed the scoping comments and their notes from the discussions at the collaborative meetings. They worked to identify areas of agreement resulting from discussions and the areas in which conflicting values may need to be balanced with resource needs. The proposed prescriptions were reviewed to clarify the objectives of the prescriptions, as well as to include some of the concepts discussed with the group in the field (leave islands, live crown ratio as a selection criteria, small openings, etc.). After much discussion, the ID Team determined that there were enough changes or modifications to treatments proposed and to the treatment locations that a new alternative was warranted. The additional alternative would incorporate elements suggested in the collaboration meetings and is intended to address concerns for habitat and connectivity. They presented this alternative to the Forest Supervisor for her determination as to whether to bring the alternative forward for detailed analysis.

Alternative 3 **-** created a new treatment M to address concerns for furbearers. It was applied within stands of red fir in size and density classes CWHR 4M and 4D to address fuels and meet DFPZ objectives, but would focus on long term improvement in marten habitat within the project area. The treatment includes promoting attributes described during the collaborative discussions, such as heterogeneity, down logs and cover, and structure.

Table 7. Comparison of proposed treatment by acres between the original Creeks project, Creeks II proposed actions as modified for mapping corrections, and alternative 3

	Original Creeks Project Treatments and Acres		Creeks II Modified Proposed Action		Creeks II Alternative 3 acres		Creeks II Alternative 3 acres as compared to:	
Treatment Description	**Tx**	**Acres**	**Tx**	**Acres**	**Tx**	**Acres**	**Creeks I**	**Mod PA**
DFPZ; surface, ladder and canopy fuels	A & B	4898	A	2995	A	2085	-1903	-910
DFPZ; surface, ladder & canopy fuels in CWHR 5M, 5D, and 6	C	395	B	94	B	97	-301	+3
DFPZ; surface and ladder fuels, 10% leave islands	E	612					-612	
DFPZ; thin modified to provide habitat connectivity			C	178	C	209	+209	+31
DFPZ; modified for marten habitat and connectivity					M	1008	+1008	+1008
DFPZ; thin within foraging habitat (CWHR 4M, 4D) adjacent to California spotted owl activity centers			O	683	O	815	+683	+132
Area Thin; surface, ladder & canopy fuels	F & G	1305	D	1406	D	1295	+101	-131
Area Thin; surface, ladder & canopy fuels in CWHR 4M, 4D, 5M, 5D & 6	H	1980	E	1765	E	1808	-215	+43
Group Selection	GS	1186	GS	640	GS	660	-546	+20
RHCA Treatment				Combined into treatment areas above		Combined into treatment areas above		
Aspen Enhancement			F	299	F	299	+299	0
Total Acres		**10,376**		**8060**		**8276**	**-2316**	**+216**

The collaborative group expressed wide ranging opinions over the number and placement of group selection units, including whether there were too many or too few groups to meet objectives for implementing this treatment. At the last stop of the July field trip, reasons for use of group selection were discussed, resulting in some understanding of the intended benefits. In line with the July 2009 field discussion, the ID Team revisited and ground-verified group selection units, evaluating them for the attributes discussed during the field review. Some proposed units were dropped, while others were added. Within the treatment M units, one-quarter to one-half acre group selection units were added adjacent to existing openings. These small group selection units are intended to maintain or improve habit for marten and their prey base.

This change in acres as a result of the collaboration discussion is shown in Table 7. It is important to note that while Creeks and Creeks II may have similar treatment names (A, B, C, etc.) *the proposed activities that correspond to those treatments names are different*. This table is intended to portray a comparison of the treatments in both projects. Attention must be given to the *treatment being used*, not the name. For example, Creeks treatment A includes DFPZ surface and ladder fuels and Creeks treatment B includes DFPZ surface, ladder, *and canopy* fuels. Creeks II treatment A includes DFPZ surface, ladder, *and canopy* fuels in one combined treatment. So, Creeks treatments A and B combined compare to Creeks II treatment A.

A description of the actions proposed in alternative 3 was mailed to the nineteen participants in the collaboration who had requested to receive it. A letter from the Lassen Forest Supervisor accompanied the alternative and maps requesting a meeting in Susanville, California, on October 23, 2009

Changes from alternative 2 based on collaborative input

There is no change to treatments A, B, C, O, D, E, or F as described in alternative 2, although there are some acreage differences (refer to Table 13). For example there is a reduction in the number of acres under treatment A which were changed to treatment M.

Project size was increased

Some discussions during the collaboration process questioned whether enough acres were proposed for treatment to meet forest health and DFPZ objectives. Mapping exercises that included areas of prior treatment were used to place the Creeks II project in the context of all treatments in the project area. Potential acres to be included with the project were highlighted. Field reviews were completed and identified additional acres to be added to proposed DFPZ and area thinning units to meet project objectives (see Table 13 for a comparison of alternative by treatment).

Group selections were altered

Discussions throughout the collaboration have focused on concerns about the number of group selections (both too few and too many) and the placement of group selections. Both aerial photographs and stand structure information were used to review potential changes in locations of group selections and potential placement of additional groups. Following the July 2009 field review, the ID Team revisited and ground-truthed group selection units with four objectives developed as a result of collaboration:

1. Eliminate group selection in healthy, thrifty mixed-conifer stands with existing vertical structure and diversity.

2. Eliminate group selection in mixed-conifer stands with a high healthy pine component or a pine component that is above approximately 60 square feet of basal area per acre.

3. Add group selection in previously thinned stands that consist of primarily white fir.

4. Add group selection to improve or maintain habitat elements for marten.

Using these objectives, group selections in mixed conifer stands that have existing vertical structure and a mix of age classes were removed. Where stands did not meet desired condition or the group selection was encompassed within a thinning unit, the group selections were converted to an existing thinning treatment designed to meet objectives for species composition, stand health, and stand structure. Group selection units were also ground-truthed for the ability to harvest the unit without causing negative impacts to adjacent or nearby riparian areas from logging operations. Overall, treatment GS would include a greater range in the size of group selections.

Under these objectives, approximately 20 acres of group selection units were added (17 of those acres are within red fir to increase stand heterogeneity). Within the treatment M and C units, ¼ to ½ acre group selections were located adjacent to existing openings. These small group selections are intended to improve or maintain habitat for marten prey.

Treatment M has been added to address concerns for furbearers

The stands that were included in treatment M are largely dominated by young trees with little to no understory vegetation and a lack of large snags and down logs with hollows that would provide marten with cover or reproductive habitat. With the current density of small trees and lack of a large tree overstory, the majority of the stands provide cover, but little in the way of habitat for prey-resting structures (the down logs and snags that marten use to escape heat and cold), or den habitat including large hollow logs or stumps.

The stands included in treatment M have a moderate to high degree of disease affecting trees of all sizes which, over time, will generally be fatal. This degree of disease has mainly been caused by the high conifer densities common to these stands. Trees have been weakened due to competition for resources and their resistance to disease has been reduced. Eventually, the larger trees will succumb to disease leaving a stand of small, dense, red fir. The value of the habitat for marten within these stands essentially continues to decline as the overstory component of large trees is lost to disease and the composition of the remaining stand changes to a thicket of young trees that contributes to an increasingly dense layer of woody debris. See the detailed description of treatment M below, and Map 3 in appendix B.

Vegetation Management

Description of treatments is the same as those proposed under alternative 2 except treatment M was added. The amount of acres proposed for treatments varies slightly from alternative 2 as indicated in Table 8.

Table 8. Vegetation management activities proposed in alternative 3

Treatment Category	Treatment[a]	Acres[b]	Acres within RHCAs
DFPZ	A	2085	128
	B	97	13
	C	209	0
	M	1008	39
	O	815	125
Area Thin	D	1295	18
	E	1808	57
Group Selection	GS	660	0
Aspen Enhancement	F	299	154
Total of all vegetation treatments		8276	534

a - Detailed descriptions of each treatment are located in appendix C.
b- Acres include treatments within RHCAs

Treatment M- DFPZ Surface, ladder and canopy fuels in CWHR 4M, 4D, and 5 size stands
Treatment M would be applied to stands within red fir that have a CWHR value of 4M, 4D, or 5. Treatment M would address fuels and meet DFPZ objectives, but focuses on long term improvement in marten habitat within the Creeks II project area.

The treatment includes guidelines that emphasize (1) stand structure, heterogeneity, and diversity by leaving a range of tree size classes in the red fir type; and, (2) the retention and development of important habitat attributes such as down logs and cover for marten and its prey. Treatment M also would incorporate untreated areas, such as riparian areas and leave islands scattered through the treatment units, to retain habitat connectivity on the landscape.

A number of elements make up treatment M and are all essential to not only retain the habitat quality that exists, but to also ensure that habitat remains or even improves over time. The elements considered in the treatment include:

a. Canopy and stand density - A target of 180 - 200 ft^2 basal area in trees greater than 10 inches d.b.h. is desired where it can be obtained. In some cases, the basal area must be taken lower to attain other habitat goals or there simply may not be that level of basal area.

b. Snags - This is one of the most important components of marten habitat, providing future down logs and den sites that will provide safe cover from the harsh winter weather as well as places for the rearing of young. Six snags per acre of the largest and best snags will be kept.

c. Understory - With few exceptions, there is very little existing understory due to the excessive stand densities. Thinning will help promote the development of understory vegetation.

d. Develop hiding cover - The treatment will obviously reduce the overhead canopy. To provide future (and better) cover for marten and habitat for marten prey, small (one-quarter to one-half acre) group selections will be placed in selected areas adjacent to existing openings to develop dense cover by shrubs and/or young trees. These groups will be left to naturally regenerate and no site preparation activities would take place (approximately 10 acres)

e. Protection of important habitat elements - To protect habitat attributes such as logs that could serve as den sites, snag patches, or other unique habitats, these areas would be designated as leave islands and would have either light treatment (removal of ladder fuels) or no treatment.

f. Connectivity - The treatment incorporates the untreated riparian areas (Riparian Habitat Conservation Areas) as travel corridors as part of the overall strategy to provide marten habitat connectivity at the landscape level.

Regeneration Treatments

Types of activities are the same as those described under alternative 2, only the amounts have changed to reflect the changes in acres proposed for treatment.

Post Harvest Fuels Treatments

Descriptions of treatments are the same as described under alternative 2 (page 25). Acres vary from alternative 2 as indicated in Table 9. See Map 6 for location of treatments.

Table 9. Post harvest fuels treatments for alternative 3

Treatment	Acres
Dozer Pile/Pile Burn	2492
Dozer Pile/Pile Burn/Broadcast	1279
Grapple Pile/Pile Burn	983
Grapple Pile/Pile Burn Outside Unit (Treatment F)	23
Grapple Pile/Pile Burn/Broadcast	1695
Mastication	861
No Post Harvest Activity	283
Site Prep	650
Total	**8277**

Road Management Activities

Activities proposed under alternative 3 are the same as alternative 2.

Alternative 4

This alternative was developed to meet the November 4, 2009 order of Judge England in Sierra Forest Legacy v. Rey requiring all forest management planning amended by the 2004 Sierra Nevada framework to consider in detail a non-commercially funded fuels reduction alternative for all projects with fuels treatment in the purpose and need. Judge England's decision did not specify how the fuels reduction alternative should be developed. For this project, the ID Team used direction from the Region that interpreted the Judge's direction to develop this alternative designed to remove fuels **only to the extent necessary** to meet project objectives related to fuels. The project objectives for fuels and wildfire management are to:

- Reduce predicted flame length to less than four feet in fire season during 90th percentile fire weather conditions;
- Provide an average canopy base height in timbered stands equal to or greater than 20 feet;
- Reduce surface fuels loads to less than 5 tons per acre of material smaller than 3 inches in diameter, and less than 10 tons per acre of material 3 inches and greater and, contribute to the continuity of the DFPZ network.

Changes from Alternatives 2 and 3

Alternative 4 proposes to use the same treatment unit areas as alternative 3, with the following adjustments:

1. Areas in which commercial thinning occurred between 1987 through 2005 have been excluded from proposed treatments under this alternative. Based on the amount of understory removal of trees within those commercial thinnings, the ladder and surface fuel objectives for this alternative have been met.

2. No group selection units are proposed under alternative 4. Proposed group selection units which are located outside of other proposed treatment boundaries were excluded. Where a group selection unit was located within the boundary of another treatment that included proposed fuels treatment, the unit was dropped as group selection but the acres were included with the encompassing proposed treatment.

3. No aspen treatments units are proposed under alternative 4. Aspen stands proposed for treatment under the Creeks II PA were excluded from consideration. These areas were intended to receive restoration treatments and did not include fuels treatments as an objective.

Vegetation Treatments

Refer to Table 10 for the number of acres by treatment category. Map 4 in appendix B displays the location of units by treatment.

Alternative 4 treatments were derived by analyzing various scenarios in which 75-100 percent of the trees within a given diameter range were thinned using the Forest Vegetation Simulator (FVS-FFE) fire behavior analysis model. A minimum average canopy cover of 30 -50 percent was maintained where available. Live and dead fuel moisture, fire weather, vegetation, and treatment variables were entered into the model to develop treatments that would meet the criteria for alternative 4. Additional details of this analysis are contained in the fuels report in the planning record.

Post-thinning surface fuel treatment would consist of surface fuel piling/pile burning or mastication. All areas proposed for treatment are intended to meet the **minimal** upper diameter limit thin and post-treatment of surface fuels needed to meet fuels objectives under alternative 4 as directed in Judge England's order.

Table 10. Vegetation treatment for alternative 4

Treatment Category	upper diameter limit in inches	Treatment Label	Treatment under Alt 2-3	Total Treatment Acres[a]	Acres within RHCAs[b]
DFPZ	14	1	A,B	1735	82
DFPZ	12	2	C,O	816	27
DFPZ	16	3	M	952	0
Area Thin	14	4	D,E	2793	74
Area thin	12	5	RHCA inner zone	183	183
Total				**6479**	**366**

a - Detailed descriptions of each treatment are located in appendix C.
b - Treatments included in Rx 1, 2, 4 pertain to the outer zone of RHCAs only. Rx 5 pertains to the inner zone RHCA.

DFPZ treatments

Trees would be thinned using a "thin from below" technique, which emphasizes removing the smaller trees and leaving the larger trees. These treatments would leave a stand structure with a reduced potential for fire to carry through the treatment area.

Treatment 1. DFPZ surface, ladder and canopy fuels

All understory conifer trees would be thinned with an upper diameter limit of 14 inches where operability allows. A minimum of 25 percent of trees at or below 14 inches in diameter would be retained. Emphasis would be placed on breaking up ladder and surface fuel continuity. A minimum canopy cover of 30 percent would be retained where available.

Treatment 2. DFPZ surface, ladder and canopy fuels

All understory conifer trees would be thinned with an upper diameter limit of 12 inches where operability allows. A minimum of 20 percent of trees at or below 12 inches in diameter would be retained. Emphasis would be placed on breaking up ladder and surface fuel continuity. A minimum canopy cover of 30 percent would be retained where available.

Treatment 3. DFPZs surface, ladder and canopy fuels

All understory conifer trees would be thinned with an upper diameter limit of 16 inches where operability allows. A minimum of 10 percent of trees at or below 16 inches in diameter would be retained. Emphasis would be placed on breaking up ladder and surface fuel continuity. A minimum canopy cover of 30 percent would be retained where available.

Area Thinning

Area thinning treatments are designed to reduce surface, ladder and canopy fuels and provide complimentary support to the DFPZ by breaking up the continuity of fuels. Trees would be thinned using a “thin from below” technique which emphasizes removing the smaller trees and leaving the larger trees.

Treatment 4. Area thinning

All understory conifer trees would be thinned with an upper diameter limit of 14 inches where operability allows. A minimum of 25 percent of trees at or below 14 inches in diameter would be retained. A minimum canopy cover of 30 percent would be retained where available.

Treatment 5. Area thinning

This treatment would apply to stands within inner zones of riparian habitat conservation areas. All understory conifer trees would be thinned with an upper diameter limit of 12 inches where operability allows. A minimum canopy cover of 30 percent would be retained where available.

Post Harvest Fuels Treatments

Treatments would be similar to those described under alternatives 2-3. See Map 7 in appendix B for location of treatments.

Table 11. Post harvest fuels treatments for alternative 4

Treatment	Acres
Dozer Pile/Pile Burn	2116
Dozer Pile/Pile Burn/Broadcast	1062
Grapple Pile/Pile Burn	901
Grapple Pile/Pile Burn/Broadcast	1595
Mastication	799
No Post Harvest Activity	7
Total	**6480**

Road Management Activities to Implement Fuels Treatments

Only transportation activities needed for fuels management treatments proposed under alternative 4 would be implemented. No decommissioning, surfacing or road crossing surfacing for watershed improvement is proposed under this alternative.

Table 12. Proposed road actions in alternative 4

Activity	**Amount**
New Classified Road Construction (existing unauthorized route)	1.9 miles
New Temporary Road Construction	1.2 miles
Decommission for watershed	0
Reconstruct Existing NFS Road	2.9 miles
Use existing unclassified as Temporary Road then decommission*(#)*	4.6 miles
Decommission OHV Trail	0
Road Surfacing (approximate)	0
Road Crossing Surfacing (approximate)	0

Alternatives Considered but Eliminated from Detailed Study

During the scoping period for the Creeks II proposed action, four commenters suggested alternatives to meet the purpose of and need for the project. Three of those parties participated in collaborative meetings and discussions for the Creeks II project providing opportunities to address their suggested alternatives and concerns. These extensive collaborative efforts resulted in the creation of alternative 3, (described on pages 32 through 37 above). Although total consensus among all participants of the collaborative process was not reached, alternative 3 addresses the group's main concerns and points from their suggested alternatives and meets the purpose and need for the project. Consistent with HFRA, one alternative from the collaborative process was brought forward for detailed analysis.

An additional alternative was suggested during scoping by one commenter who did not participate in the collaboration discussions. This party requested the team fully consider an alternative that includes:

- a 16-inch diameter limit in mechanical thinning treatment areas retaining:
    - at least 70 percent canopy cover in dominant and co-dominant trees where current canopy cover is over 70 percent;
    - at least 60 percent canopy cover in dominant and co-dominant trees where current canopy cover is 60 percent to 70 percent;
    - at least 50 percent canopy cover in dominant and co-dominant trees where current canopy cover is 50 percent to 60 percent; and,
    - at least 40 percent canopy cover where current canopy cover is 40 percent to 50 percent;
- a 20-inch diameter limit in group selection units
- group selection units only in CWHR size classes 2 and 3

The ID Team analyzed the proposed alternative and determined that it would not fully achieve project objectives 1, 3, and 5 described in Chapter 1, Purpose and Need for Action. After review, the ID Team recommended that this alternative be eliminated from detailed study because it would not fully meet the purpose of or resolve the need for the project.

Comparison of Alternatives

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

Table 13. Comparison of alternatives by treatment

<table>
<tr><th>Treatment Category</th><th>Treatment</th><th>No-action Alt 1</th><th>Modified Proposed Action Alt 2</th><th>Alt3</th><th>Alt 4</th></tr>
<tr><td>DFPZ</td><td>A</td><td>0</td><td>2995</td><td>2085</td><td rowspan="2">1735</td></tr>
<tr><td>DFPZ</td><td>B</td><td>0</td><td>94</td><td>97</td></tr>
<tr><td>DFPZ</td><td>C</td><td>0</td><td>178</td><td>209</td><td rowspan="2">816</td></tr>
<tr><td>DFPZ</td><td>O</td><td>0</td><td>683</td><td>815</td></tr>
<tr><td>DFPZ</td><td>M</td><td>0</td><td>0</td><td>1008</td><td>952</td></tr>
<tr><td colspan="2">Total Acres DFPZ</td><td>0</td><td>3950</td><td>4214</td><td>3503</td></tr>
<tr><td>Area Thin</td><td>D</td><td>0</td><td>1406</td><td>1295</td><td rowspan="2">2793</td></tr>
<tr><td>Area Thin</td><td>E</td><td>0</td><td>1765</td><td>1808</td></tr>
<tr><td colspan="2">Total Acres Thin</td><td></td><td>3171</td><td>3103</td><td>2793</td></tr>
<tr><td>Group Selection</td><td>GS</td><td>0</td><td>640</td><td>660</td><td>0</td></tr>
<tr><td>Aspen Enhancement</td><td>F</td><td>0</td><td>299</td><td>299</td><td>0</td></tr>
<tr><td>Area Thin</td><td>RHCA Inner Zones</td><td>0</td><td>188</td><td>188</td><td>183</td></tr>
<tr><td colspan="2">Total Acres All Treatments</td><td>0</td><td>8060</td><td>8276</td><td>6479</td></tr>
</table>

Table 14. Comparison of road treatments by alternative

	Alt 1	**Alt 2 and 3**	**Alt 4**
	Miles		
New Classified Road Construction (existing unauthorized route)	0	1.9	1.91
New Temporary Road Construction	0	3.6	1.21
Decommission	0	11.1	0
Reconstruct Existing NFS Road	0	3.0	2.90
Use existing unclassified as Temporary Road then decommission(#)	0	5.2	4.6
Proposed Maintenance Level 1 (+)	0	1.6	0
Decommission OHV Trail	0	1.0	0
Road Surfacing (approximate)	0	7.3	0
Road Crossing Surfacing (approximate)	0	72 crossings	0

Table 15. Comparison of alternatives by responsiveness to purpose and need indicators

Needs Addressed	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Improve Forest Health, habitat heterogeneity (objectives 1, 4,5,6)				
Number of acres of treatment to reduce SDI below 60% SDI	0	**8060**	**8276**	**6479**
Acres of aspen stands treated	0	299	299	0
Snags per acre	3 (Current levels)	Minimum of 4 – 6/acre	Minimum 4 – 6/acre	4 - 6 acre
Acres with an increase in average stand diameter	0	6,492	6,524	6,231
Economic Efficiency(Objective 3)				
Revenues generated		$8,307,090	$8,504,562	$4,951,568.40
Benefit cost ratio	n/a-	2.04	1.87	1.58
Number of jobs created	0	714	731	425
Income created	0	$31,278,399	$32,021,936	$18,643,971.00
Increase diversity in size class 4 stands (Objective 4)				
Number of/or acres canopy gaps created to enhance stand structure and enhance pine regeneration	0	640	660	0
Watershed Improvement (Objectives7)				
Cubic yards of sediment reduced	No change	25 tons per year	25 tons per year	No Change
RHCA Road density reduced (miles^2)	No Change	2.3	2.3	No Change
RHCA habitat improvement (Objective 8)				
Acres of treatment in RHCA	0	533	533	366
Change in stand density	No change	73 percent reduction	77 percent reduction	77 percent reduction
Change in average stand diameter	No change	45 percent increase	45 percent increase	55 percent increase
Change in percentage max SDI	No change	19 percent decrease	19 percent decrease	13 percent decrease
Change in Canopy base height	No change	44 percent increase	44 percent increase	
Change in surface fuels	No change	32 percent decrease	32 percent decrease	
Fire behavior and fuels (objective 2)				
Fire type average	Passive Crown Fire	surface fire	surface fire	surface fire
Flame length range	3.5-6.3 feet	1.2-2.3 feet	1.2-2.3 feet	1.2-2.4 feet
Flame length average	5.1 feet	2.2 feet	2.2 feet	1.7 feet
Canopy base height range	4 to 9 feet	8 to 33 feet	8 to 33 feet	18 to 22 feet
Canopy base height average	6 feet	19 feet	19 feet	20 feet
Average amount for <3" diameter fuels	9.8 tons	3.1 tons	3.1 tons	2.9 tons
Average amount of surface fuels > 3" diameter	11.7 tons	3.1 tons	3.1 tons	3.3 tons

a - Forests at 60% maximum stand density (SDI max) or greater are in the zone of imminent mortality. At this density, less vigorous trees die due competition and all trees are stressed making them susceptible to large-scale die-off due to insect or disease.

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource.

Fire and Fuels

Introduction

The purpose of this analysis is to provide a clear basis on which the deciding official can make an informed alternative selection. Fire behavior and fuels condition analyses within this report show the differences and environmental effects in key fire and environmental variables among alternatives 1-4.

Regulatory Direction

Alternatives 2, 3, and 4 comply with National Fire Plan goals, Lassen Forest Plan goals, standards, guides, and objectives, stated below.

Federal Policy

The Federal Wildland Fire Policy (USDI et al. 1995, 2001) guiding principles of the Federal Wildland Fire Policy include:

- Ensuring firefighter and public safety is the first priority;
- recognizing and incorporating the role of wildland fire as an essential ecological process and natural change agent into the planning process;
- basing fire management plans and activities on the best available science;
- and incorporating public health and environmental quality considerations into fire management plans and activities.

Healthy Forest Initiative, Healthy Forest Restoration Act (HFRA), and the Wildland-Urban Interface (WUI)

The Healthy Forest Restoration Act (Healthy Forests Initiative 2002; Healthy Forests Restoration Act 2003) directs agency personnel to improve forest conditions through fuels reduction activities. The Healthy Forest Initiative provides administrative reform to aid in accomplishing this task.

To meet the direction of the HFRA, The Plumas County Fire Safe Council (PC FSC) developed the Plumas County Community Wildfire Protection Plan (PC CWPP) in 2004-2005 that includes WUI designation to meet the standards and guidelines of the HFRA. The PC CWPP purpose is to outline the risks and hazards associated with a wildland fire threats to Plumas County communities and to recommend mitigation measures to protect the public, firefighters, natural resources, and private property. The plan was a collaborative effort among federal, state, and private shareholders and meets the requirements of the HFRA. A key part of the PC CWPP planning process was to identify “communities-at-risk” (a community at risk from a wildfire originating on public lands) and boundaries of the WUI.

In developing the PC CWPP WUI, prevailing winds were also a factor in strategic placement. Prevailing winds during fire season in the Creeks II project area WUI historically come from the southwest and tend to push fire to the northeast. Recent examples of this are the Storrie Fire (2000) and the Cub/Onion Complexes (2008). Both of these large fires occurred within close proximity to the Creeks II project area and became a threat to the Lake Almanor Basin and the community of Chester. Segments of the Plumas County CWPP WUI have been strategically placed within the Creeks II project area not only to protect those communities within the WUI, but also serve as a buffer to stop or slow wind-driven fires from the southwest and increase the opportunities to suppress fires moving towards the Lake Almanor Basin.

In November 2010 the Plumas County Board of Supervisors (PC BOS) approved the WUI Map (PC BOS 2010, PC FSC CWPP 2010). The WUI zones were developed to meet the standards and guidelines of the HFRA.

Forest Plan Goals

The following are Lassen Forest Plan goals relevant to fire and fuels:

- Restore fire to its natural role in the ecosystem when establishing the desired future condition of the landscape (Lassen Forest Plan; page 3-8).
- Reduce activity fuels that remain after meeting wildlife, riparian, soil, and other environmental needs will be considered surplus and a potential fire hazard (Lassen Forest Plan; page 3-8).
- Plan and implement fuel treatments, emphasizing those treatments that will replicate fire's natural role in the ecosystems (Lassen Forest Plan; page 3-8).

Methodology

USDA Forest Service Region 5 (California) Common Stand Exams (CSE) inventories were conducted throughout the Creeks Project Area from 1998 through 2008. Inventories were completed within management areas (Lassen Land and Resource Management Plan) that overlap with the Creeks II project area. Standard silviculture measurements were collected using random sampling methods. The stand exam data was used as inputs to the Forest Vegetation Simulator-Fire and Fuels Extension Model (FVS-FFE 2009) to analyze surface and ladder fuel conditions and fire behavior potential to show various impacts that would occur using the different management alternatives.

This data was then extrapolated across units with similar vegetation composition. Stand exam and fuels data were processed through FVS-FFE. The Northern California variant of the Forest Vegetation Simulator (FVS-FFE; Keyser et al. 2010) was used to simulate silvicultural treatments proposed in the action alternatives. FVS-FFE was used to predict canopy fuel conditions and fire behavior potential both prior to and following various types of silviculture and fuels treatments. Additional details on modeling and analysis are contained in the fuels report in the planning record.

"**Percentile weather**" refers to the frequency of occurrence of a particular set of weather and fuel moisture conditions in the historical record for a given area. Extreme weather that occurs on10 percent of the days during fire season (June 1-September 30) is referred to as 90th percentile weather and is characterized by hot, dry winds, low humidity, and very dry fuels (Burkholder 2006). 90th percentile weather conditions are used in this analysis to predict fire behavior under these extreme fire weather conditions. The weather indices and environmental factors for 90th percentile fire weather and fuel conditions are detailed in the fuels report in the planning record. These variables were used as inputs in modeling fire behavior in FVS-FFE.

Objectives

Objective 2, outlined in the purpose and need, is to protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel. This objective is addressed in the following fire and fuels analysis and is based on standards and guidelines for fire and fuels management within the Sierra Nevada Forest Plan Amendment (2004 Final Environmental Impact Statement).

The specific goals of objective 2 are to:

- connect to an existing DFPZ network
- create a safe location for fire-fighting personnel to conduct fire-suppression activities by reducing predicted flame length to less than 4 feet and reducing surface fuel loads to less than 5 tons per acre of material less than 3 inches in diameter and less than 10 tons per acre of material 3 inches and greater in diameter
- Reduce the potential for crown fire (fire in the tree canopy) both within and outside of DFPZs and area thins by having canopy base heights at 20 feet or above while reducing the number of entries required to meet and maintain DFPZ effectiveness for 20 years.

Measurement Indicators

In order to provide a meaningful comparison of how this objective is met across the alternatives, the following measurement indicators were developed for use in the analysis. Desired conditions are described for each indicator.

Predicted flame length (measured in feet)

An effective quantitative measure for evaluating wildfire is flame length. Flame length is the average length of flames at the front of a fire where the intensity is generally the greatest. The predicted flame length is based on wildland fire behavior models developed and published by the National Wildfire Coordinating Group (Rothermel 1983). The models use a number of attributes to predict the flame length including vegetation, weather, fuels and their arrangement, and topography. The primary attribute in the model used here is surface fuels (measured in tons/acre).

Flame length is used to represent potential fireline intensity which indicates how hard a wildfire is to suppress. Flame lengths less than 4 feet are desired to allow for safe direct attack by hand crews. Conversely, flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft. Flame lengths exceeding 8 feet promote torching, crowning, and increase the potential for spot fires.

Fire type (surface, passive crown or active crown)

Fire type represents the intensity of the fire. Surface fire burns only the fuels at or near the surface without torching the trees above—this is the desired condition. Passive crown fire torches out individual or small groups of trees as the surface fuels burning under them provide the convective heat to ignite the above-ground fuels. Active crown fire is spread from tree to tree in conjunction with the convective heat of the surface fuels burning under them.

Surface Fuels (measured in tons per acre)

Surface fuels are the organic material at and/or immediately above the surface level of ground fuels, such as pine needle litter, dead and down woody material. For this analysis surface fuels are assessed in two size categories, 0-3 inches and greater than three inches. This is because fuels under 3 inches in diameter are considered fine fuels and are most critical to fire ignition. Fuels 0-3 inches in diameter are typically fast-drying, dead fuels which ignite readily and are consumed rapidly when dry. This typically includes grass, leaves, draped pine needles, and small twigs. Fuels larger than 3 inches are larger down wood material that dries at a slower rate than the 0-3 inch material. Once ignited, these larger fuels burn at higher intensities and for longer duration than the smaller surface fuels.

Desired conditions include no more than 5 tons per acre of down woody material from 0-3 inches diameter and no more than 10 tons per acre of woody material greater than 3 inches in diameter.

Reduction of surface fuel loads would result in decreased rates-of-spread, smaller flame lengths, lower fireline intensities, and reduced tree mortality in the event of wildfire.

Canopy base height

Canopy base height is the lowest height above the ground where there is sufficient canopy fuel to spread fire. Canopy base height is an effective value that incorporates ladder fuels such as shrubs and understory trees (Scott and Reinhardt 2007). When canopy base heights average greater than 10 feet within conifer forests, with relatively low surface fuel loads, a low to moderate fire environment is established (Scott and Reinhardt 2001)

Desired conditions for this project are to reduce the potential for crown fire initiation and spread (fire in the tree canopy) both within and outside DFPZs by raising canopy base heights to 10 feet or above. The objective is to raise the canopy base height to 20 feet where achievable by implementing silvicultural prescriptions for thinning trees while adhering to guidelines for canopy cover retention and tree stocking.

Affected Environment

Existing Condition

The fuels/vegetation profile in the Creeks II project area can be described as a mosaic of generally dense conifer tree overstory, interspersed with meadows, open rocky areas, areas of brush cover, and small to moderate sized aspen stands. Cumulatively, the existing vegetation profile in much of the Creeks II project area represents a fuel complex (live and/or dead vegetation) comprised of three distinct fuel profiles: ground, surface and aerial. Ground fuels are considered the organic material (vegetation) in the ground and/or immediately under surface litter layers, such as duff, roots, and decomposing logs. Surface fuels are the organic material at and/or immediately above the surface level of ground fuels, such as pine needle litter, and dead and down woody material. Aerial fuels are the organic materials associated with stand canopies that are composed of brush and all size classes of both live and dead trees and their crowns. A combination of surface ladder fuels that are vertically and horizontally connected throughout the project have created a hazardous fuels complex. The implication is that high-intensity wildfire with rapid rates of spread and passive crown fire would occur under extreme fire weather conditions throughout the project area (Table 17).

Stand structure and wildfire behavior are clearly linked (Rothermel 1991). Surface fuels are recognized as one of the primary factors affecting fire behavior. They are a critical component in wildfire initiation and most forms of sustained fire spread on both the forest floor surface and into the crowns of trees. Active wildland fires initially ignite in surface fuels, which influence fire intensity and horizontal and vertical spread based on fuel loading (mass of material in tons/acre), fuel arrangement (vertical and horizontal), fuel type (grass, brush, timber litter, slash), fuel continuity, fuel moisture content, wind speed and direction and slope (Scott and Reinhardt 2001). Although the surface fuel loading throughout the project area is moderate, some reduction is recommended. The combination of moderate surface fuel loading, highly dense stands, and low average canopy base height has resulted in a hazardous fire environment throughout the project area. Under these conditions, there exists the potential for high fire intensity and spread.

The current condition of surface fuels were assessed by diameter class and expressed as tons-per-acre. Table 16 shows that under current stand conditions, surface fuel loads in all treatment areas are moderate and exist as a contributor to a hazardous fire environment.

Table 16. Down woody material surface fuel loads by the treatment areas within the Creeks II project area under current stand conditions

Treatment	Surface Fuels 0-3 inch diameter (tons/acre)	Surface Fuels >3 inch diameter (tons/acre)	Surface Fuels >12 inch diameter (tons/acre)	Desired Future Conditions for Fuel Loading
A - DFPZ	12.1	12.0	0.7	Fine Surface Fuels (0 – 3 inch diameter): Less than 3-5 tons per acre. Large Surface Fuels (>3 inch diameter): Less than 8-10 tons per acre
B - DFPZ	12.6	13.2	2.0	
C – DFPZ	13.1	13.2	1.1	
D - Area Thin	11.8	10.6	0.1	
E - Area Thin	4.5	10.0	0.1	
O - DFPZ	6.9	10.4	0.2	
M - DFPZ	12.1	12.0	0.7	
RHCA	5.3	11.8	N/A	

Source: Forest Vegetation Simulator (FVS) model outputs based on Almanor Ranger District stand exam record inputs.

In addition to affecting fire intensity and horizontal spread, surface fire also plays a critical role in influencing the development and sustained spread of vertical fire movement commonly recognized as crown fire (fires that burn the canopy vegetation of trees and large shrubs). When moderate surface fuel loads occur together with low canopy base height in the same place, the potential for surface fire to burn into the crowns of trees increases. Crown fire behavior is classified into two categories: passive crown fire and active crown fire. Passive (torching) crown fire is moderate to high-intensity fire that involves the crown of a single tree or crowns of a small group of trees. Active crown fire involves a whole stand or large area of trees at single or multiple flaming fronts associated with high intensity and severity fires. Under current surface and ladder fuel conditions there is a great likelihood that both passive and active crown fire could occur during fire season. Those types of fires are most likely to occur from July through September in the project area.

Table 17 shows the predicted fire behavior and canopy base height under current stand conditions by the treatment areas that are described in the proposed action alternatives within the Creeks II project area.

Table 17. Predicted fire type, flame lengths, and canopy base height (CBH) by the treatment areas within the Creeks II project area under current stand conditions

Treatment	Predicted Fire Type	Average Flame Lengths[a]	Average CBH
A - DFPZ	Active Crown Fire/Passive Crown Fire	5.7	6
B - DFPZ	Active Crown Fire	6.3	6
C - DFPZ	Active Crown Fire	6.1	7
D – Area Thin	Active Crown Fire	4.1	3
E – Area Thin	Active Crown Fire/Passive Crown Fire	4.1	3
O - Area Thin	Active Crown Fire/Conditional Crown Fire	4.6	7
M - Area Thin	Active Crown Fire/Passive Crown Fire	4.4	9
RHCA - Area Thin	Passive/Active Crown Fire	4.2	4

Source: Forest Vegetation Simulator (FVS) model outputs based on Almanor Ranger District stand exam record inputs.
a - The fire model for predicting flame lengths the Forest Vegetation Simulator-Fire and Fuels Extension (FVS-FFE) used 90th percentile fire weather and environmental inputs.

Table 17 shows that current surface and ladder fuels conditions within all proposed treatment areas present a hazardous fire environment by having a combination of moderate surface fuel loads and low canopy base heights. That type of environment creates a risk for high-intensity wildfire (Peterson 2005, Graham 2004). Table 17 shows that the canopy base height throughout all proposed treatment areas are relatively low, ranging 4-7 feet. Although moderate, the surface fuel loading within the same areas (Table 19) is high enough that when burning under moderate to high fire weather conditions, flame lengths would be high enough to transition into the crowns of trees. The predicted fire type in all of the Creeks II project area during fire season would be mostly active crown fires and passive crown fires (Table 17). Both active and passive crown fire presents much difficulty in suppression action and firefighter safety. Active and passive crown fires are often manifested as extreme fire behavior due to rapid rates of spread, long flame lengths, and high fireline intensities. Crown fire activity can result in undesirable direct and indirect environmental impacts, such as erosion, sedimentation, and loss of wildlife habitat. A significant amount of forest health and ecosystem management activities focus on treating fuel profiles that contribute to the development of this type of fire behavior. Also shown in Table 17 are the average predicted flame lengths for each area. Estimated flame lengths within the proposed DFPZ areas (treatments A-C) range from 5.7 to 6.3 feet. Flame lengths within the proposed area thinning (treatments D-M, RHCA) range from 4.1 to 5.7 feet.

Table 17 also shows the current ladder fuel conditions, expressed as canopy base height. Ladder fuels are those fuels that enable fire to transition from the surface fuel profile up into the tree crowns and canopy. These fuels are a combination of canopy fuels, such as the intermediate tall brush with pine needle litter suspended in the canopy that transition directly up into low hanging branches of pine trees in parts of the proposed project area. Overall, ladder fuel conditions throughout the Creeks II project are described as hazardous in terms of the fire environment. Canopy base height within treatment areas A-C average 6 feet. Canopy base height within treatment areas D-M and RHCAs range from 4 to 9 feet. When canopy base heights average less than 10 feet within conifer forests that have moderate surface fuel loads, a hazardous fire environment for ladder fuels is established. The relatively low average canopy base height creates a situation where fire could readily transition from surface to the crowns of trees under favorable fire weather and fuel moisture conditions.

Based on current fuel profiles within the project area, the threat of high intensity and high severity fire under moderate to extreme fire weather conditions have potential to transition into passive or active crown fire, resulting in excessive flame lengths. Furthermore, type of predicted fire during extreme fire weather (active and passive crown fire, Table 17 would limit suppression options and effectiveness, threaten public and firefighter safety, and threaten private and public property and resources.

Environmental Consequences

Direct and Indirect Effects

The effects of the Creeks II project on fuels and fire potential as it relates to the measurement indicators, effects to the WUI, prescribed burning effects and impacts to air quality are summarized in this section. Additional information is contained in the fuels report located in the planning record.

The effects analysis for alternatives 2 and 3 are combined. Overall, the results of the effects analyses for both surface/ladder fuel conditions and fire behavior for the two alternatives were similar enough to justify this combination.

Wildland-urban Interface (WUI)

The wildland-urban interface zone (WUI) is an area where human habitation is mixed with areas of flammable wildland vegetation. The WUI is an area of special consideration for wildland fire suppression due to the risk of lives and property. The WUI extends out from the edge of developed private land into Federal, private, and State jurisdictions. The WUI is the buffer in closest proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities. WUI zones generally extend roughly 1.5 miles out from these areas; however, actual WUIs are determined at by national, regional, and forest policy. The Healthy Forests Restoration Act (HFRA) identifies wildland fire protection areas to be included in the WUI. The WUI protection areas should be of sufficient extent that fuel treatments within them will reduce wildland fire spread and intensity sufficiently for suppression forces to succeed in protecting human life, property, and natural resources. Desired conditions within WUIs are:

- Stands in WUI zones have relatively open canopies are and dominated primarily by larger, fire tolerant trees
- Surface and ladder fuel treatments are such that crown fire ignition is highly unlikely
- The openness and discontinuity of crown fuels, both horizontally and vertically, result in very low probability of sustained crown fire.

Within the Creeks II project area, there are 18,396 (28.7 square miles) acres of WUI that have been designated by Plumas County under the Healthy Restoration Act (HFRA) authority (Figure 15). All proposed fuel treatments would enhance the desired conditions for WUI fire protection zones by reducing surface and ladder fuels, becoming more open and dominated primarily by larger, fire tolerant trees, and reducing the potential for crown fire initiation and spread.

Table 18. Proposed treatments within the Wildland-urban Interface (WUI)

Alternative	Proposed fuel treatments within WUI in Creeks II (total acres)	All proposed fuel treatment areas in Creeks II (total acres)	Percentage of Creeks II fuel treatments within WUI (%)
1	0	0	0
2	3684	8060	46
3	3864	8276	47
4	2955	6479	46

Source: Lassen National Forest Geodatabase.
Note: There are 18,396 acres of designated PC CWPP WUI within the Creeks II project area boundary.

Under all of the Creeks II action alternatives, some areas within WUIs were not proposed for any treatment for a variety of reasons. Those include areas that are:

- Private property
- Greater than 35 percent slope
- Owl protected activity center (PAC)/Goshawk PAC.

Alternative 1

In alternative 1, none of these WUI acres would undergo any fuels treatment that would enhance the WUI wildland fire protection areas. Figure 15 through Figure 17 shows the where the WUI is located within the Creeks II project area.

Alternatives 2-3

Within the Creeks II project area there are 3684 acres of surface and ladder fuel treatment that would occur inside of the designated WUI under alternative 2 (Figure 15). Alternative 3 would treat surface and ladder fuels over 3864 acres inside of the WUI (Figure 16). The indirect effects are that proposed fuel treatments for alternatives 2 and 3 in the WUI would enhance the desired conditions of the fire environment in these zones by reducing surface and ladder fuels in the DFPZ, RHCA, area thins, becoming more open and dominated primarily by larger, fire tolerant trees, and reducing the potential for crown fire initiation and spread.

Alternative 4

Within the Creeks II project area there are 2955 acres of surface and ladder fuel treatment that would occur inside of the designated WUI under alternative 4 (Figure 17). The indirect effects are that proposed fuel treatments in alternative 4 in the WUI would enhance the desired conditions within these fire protection zones by reducing surface and ladder fuels, becoming more open and dominated primarily by larger, fire tolerant trees, and reducing the potential for crown fire initiation and spread.

Surface Fuels

Surface fuels are recognized as one of the primary factors affecting fire behavior. They are a critical component in wildfire initiation and most forms of sustained fire spread on both the forest floor surface and into the crowns of trees. Active wildland fires initially ignite in surface fuels, which influence fire intensity and horizontal and vertical spread based on fuel loading (mass of material in tons/acre), fuel arrangement (vertical and horizontal), fuel type (grass, brush, timber litter, slash), fuel continuity, fuel moisture content, wind speed and direction and slope (Scott and Reinhardt 2001). The amount and type (size) of surface fuels was predicted post-treatment by alternative and compared to existing conditions in Table 19.

Types of Fuels

Ground fuels are considered the organic material (vegetation) in the ground and/or immediately under surface litter layers, such as duff, roots, and decomposing logs.

Surface fuels are the organic material at and/or immediately above the surface level of ground fuels, such as pine needle litter, dead and down woody material, and brush.

Ladder fuels are those fuels that enable fire to transition from the surface fuel profile up into the tree crowns and canopy.

Aerial fuels are the organic materials associated with stand canopies that are composed of tall brush and all size classes of both live and dead trees and their crowns.

Table 19. Predicted surface fuels by alternative

Alternative	0 – 3 Inch diameter fuels in tons/ac		Greater than 3 inch diameter fuels in tons/ac	
	Range	Average	Range	Average
1	4.5-13.1	9.8	10.0-13.2	11.7
2	1.4-4.9	3.1	2.8-4.4	3.1
3	1.4-4.9	3.1	2.8-4.4	3.1
4	1.4-4.8	2.9	3.1 - 3.4	3.3

These numbers do not reflect treatments in RHCAs; see Table 82 for RHCA surface fuels data.

Surface fuel treatments would be achieved by a combination of dozer piling, grapple piling, and mastication. All piles would be burned.

Table 20. A comparison of surface fuels treatment by alternative and corresponding acres

Treatment Type	Acres of Treatment by Alternative			
	Alt 1	Alt 2	Alt 3	Alt 4
Dozer Pile/Pile Burn	0	2424	2492	2116
Dozer Pile/Pile Burn/Broadcast Burn	0	2184	1279	1061
Grapple Pile/Pile Burn	0	953	983	901
Grapple Pile/Pile Burn/Broadcast Burn	0	722	1695	1595
Mastication	0	827	862	799
Grapple Pile/Burn Piles Outside of Units	0	23	23	0
Group Selection Site Preparation	0	640	650	0
No Surface Fuel Treatment	0	283	293	7
Total	**0**	**8056**	**8277**	**6479**

Alternative 1

Under the no-action alternative, a continual increase in fuel loading would occur across the project area over time. Down woody material would be added to the forest floor annually at a rate that is greater than decomposition. The absence of thinning or fuels treatments would allow ingrowth of undesirable, shade-tolerant trees to increase. As stands become denser with understory ingrowth, trees and shrubs become stressed. As a result, mortality increases. As the understory and canopy vegetation begins to die, fuel loading on the forest floor begins to amplify. Dead brush and trees that are left standing serve as ladder fuels. These factors, individually and combined, would cause an increase in the probability of stand replacement in the event of a wildfire. Predicted increase in fire behavior would also create a high rate of residual tree mortality.

Under a no-action alternative, use of prescribed fire and pile burning as a means to decrease fuel loads would not occur within the project area. As the fire environment would continue to exist in a state of hazard, National Fire Plan standards to achieve desired conditions for wildland fire behavior would not to be achieved. Both surface and ladder fuels would continue to increase, which would increase the risk of a high intensity fire, should a fire become established. The chance of an ignition in the project area would remain the same. Fire starts occur in a random manner in the project area and would continue to do so in the future. The number of starts in the project area is expected to remain about the same in the future.

Figure 4 through Figure 6 are models of the current condition of the stand (alternative 1) before, during, and after fire under 90th percentile weather conditions within a typical stand that is proposed for DFPZ treatment (treatment A) under alternatives 2, 3, and 4. The models in these figures depict a hazardous fire environment that features continuous ladder fuel and high surface fuel loading. The models show that, under the current stand condition, wildfire during extreme weather would result in high-intensity fire and high rates of tree mortality.

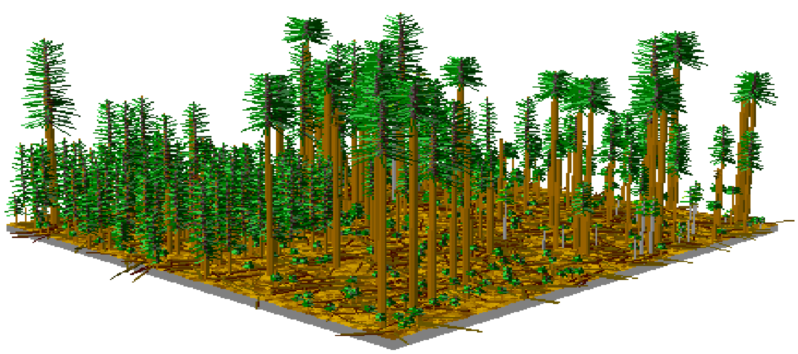


Figure 4.Three dimensional model depicting the structure and composition of surface and ladder fuels within a typical stand prior to any treatment. (This is a model of a stand that is proposed to be treated in developing a DFPZ under treatment A in both alternatives 2 and 3).

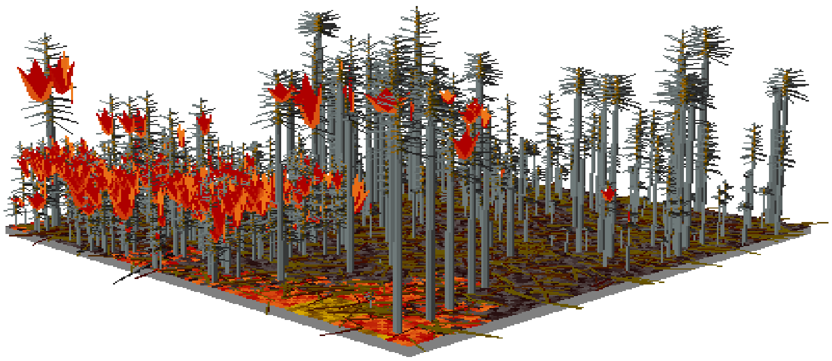


Figure 5. Fire behavior under 90th percentile weather in a typical stand that has not been treated (alternative 1). (Surface and ladder fuels would be treated under treatment A within this stand in developing a DFPZ under alternatives 2 and 3).

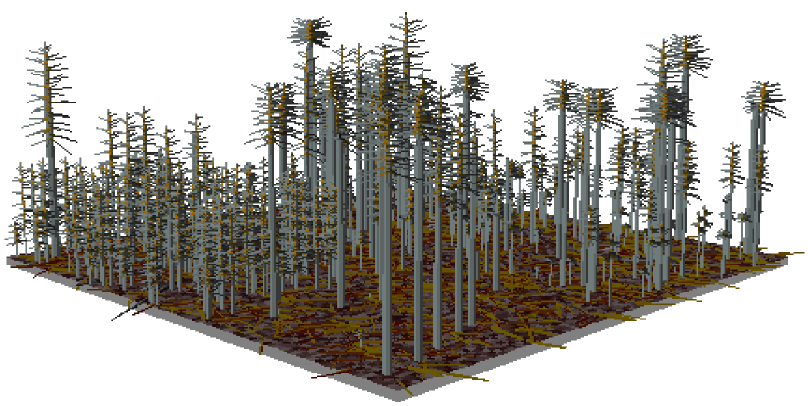


Figure 6. Post-fire condition of typical stand that has not been treated (alternative 1)

Alternatives 2-3

Thinning of conifers in forested stands and subsequent surface fuel treatment would result in reduced aerial, ladder and surface fuel loads. The indirect effect would be to reduce hazardous wildland fire behavior from fires both originating within treatments and from outside point sources (Graham et al. 1999). Treatment of surface, ladder, and canopy fuels in the conifer stands would help protect other natural resources in and around the stands while increasing safety for firefighters. The ability to safely directly attack a fire would increase and fireline production rates would improve. These changes would, in turn, slow down a flaming fire front once it has moved into treated stands. Because wildfires would become more manageable, associated smoke would be less intense and would produce lower particulate emissions and for shorter durations, when compared to the larger and more intense fires that would occur under current conditions.

To achieve project objectives, surface fuel treatments would be implemented to decrease the amount of down woody material in DFPZ, area thin and RHCA areas. Both surface fuel piling and pile burning would be implemented to treat surface fuels. Table 21 shows the fuel loads that would result from surface fuel treatments within each treatment area. To meet surface fuels measurement indicators within all treatment areas:

- No more than 5 tons per acre of 0-3 inch down woody material be left following surface fuel treatments.
- No more than 10 tons per acre of down woody material greater than 3 inches be left.

Some of the large down woody material would remain on site. This large down woody material is defined as logs greater than 12 inches diameter at the small end and a minimum of 6 feet in length. Where they exist, a minimum of 4 logs per acre would remain on site following any surface fuel treatment.

Table 21 shows what the surface fuel loading would be following treatments prescribed under alternatives 2 and 3. Following treatment, surface fuel loads in all treatment areas meet the management objectives outlined in the proposed action. The recommended treatment of these surface fuel profiles with the proposed treatments would reduce the potential for high intensity, stand-replacing wildfires.

Table 21. Down woody material surface fuel loads by the treatment areas within the Creeks II project area following prescribed treatment under alternatives 2 and 3

<table>
<tr><th>Treatment</th><th>Surface Fuels 0-3” diameter tons/ac</th><th>Surface Fuels >3” diameter tons/ac</th><th>Surface Fuels >12” diameter tons/ac</th><th>Alternatives 2 and 3 Post-Treatment Fuel Loading</th></tr>
<tr><td>A - DFPZ</td><td>3.5</td><td>3.4</td><td>0.2</td><td rowspan="8">Fine Surface Fuels (0 – 3 inch diameter): Less than 5 tons per acre.

Large Surface Fuels (>3 inch diameter): Less than 10 tons per acre</td></tr>
<tr><td>B - DFPZ</td><td>3.8</td><td>3.8</td><td>0.6</td></tr>
<tr><td>C - Area Thin</td><td>3.9</td><td>3.7</td><td>0.3</td></tr>
<tr><td>D - Area Thin</td><td>3.4</td><td>3.0</td><td>0.1</td></tr>
<tr><td>E - Area Thin</td><td>1.4</td><td>2.8</td><td>0.1</td></tr>
<tr><td>O - Area Thin</td><td>2.2</td><td>2.9</td><td>0.1</td></tr>
<tr><td>M - Area Thin</td><td>4.9</td><td>3.4</td><td>0.2</td></tr>
<tr><td>RHCA - Area Thin</td><td>2.0</td><td>4.4</td><td>N/A</td></tr>
</table>

Source: Forest Vegetation Simulator (FVS) model outputs based on Almanor Ranger District stand exam record inputs.

Table 22 shows surface fuel treatments that would occur with alternatives 2 and 3. Under current conditions, these areas have moderate fuel loadings (Table 19). The direct effect of these treatments would be surface fuels reduction over approximately 8000 acres under alternatives 2 and 3. The indirect effect would be reducing the risk of high intensity fire within these areas, specifically crown fire initiation and spread.

Table 22. Alternatives 2 and 3 surface fuel treatments types by treatment and corresponding acres

Surface Fuel Treatment Type	Treatment	Alternative 2 Acres	Alternative 3 Acres
Dozer Pile/Pile Burn	A	188	187
	D	871	869
	E	1364	1435
	O	1	1
	TOTAL	**2424**	**2492**
Dozer Pile/Pile Burn/Broadcast Burn	A	2134	1279
	D	50	0
	TOTAL	**2184**	**1279**
Grapple Pile/Pile Burn	A	159	121
	B	94	97
	C	178	209
	D	79	18
	E	400	416
	M	0	24
	O	42	96
	TOTAL	**953**	**983**
Grapple Pile/Pile Burn Outside of Units	F	23	23
	TOTAL	**23**	**23**
Grapple Pile/Pile Burn/Broadcast Burn	A	97	50
	M	0	969
	O	625	676
	TOTAL	**722**	**1695**
Mastication	A	409	442
	D	406	408
	O	12	12
	TOTAL	**827**	**862**
Group Selection Site Preparation	**TOTAL**	**640**	**650**
No Surface Fuel Treatment	A	7	7
	F	276	276
	GS	0	10
	TOTAL	**283**	**293**
Total Acres		**8060**	**8276**

Figure 7 through Figure 14 are models of the current condition and post-treatment of the stand (alternative 2 and 3) before, during, and after fire under 90th percentile weather conditions within a two typical stand that are proposed for DFPZ treatment under alternatives 2 and 3. The models in these figures depict pre-treatment hazardous fire environments that feature continuous ladder fuel and high surface fuel loading. The post-treatment models noticeably increases crown base heights and reduces surface fuel loading. The models show that, following DFPZ treatments (prescriptions A and B), wildfire during extreme weather would result in low to moderate intensity fire with relatively low rates of tree mortality.

Figure 7. Model depicting the structure and composition of surface and ladder fuels within a typical stand prior to any treatment. (This is a model of a stand that is proposed to be treated in developing a DFPZ under prescription A in both alternatives 2 and 3).

Figure 8. Model of the structure and composition a typical stand following treatment A surface and ladder fuel treatment in DFPZ (alternatives 2 and 3)

Figure 9. Model of fire behavior under 90th percentile weather in a typical stand following treatment A surface and ladder fuel treatment in DFPZ (alternatives 2 and 3)

Figure 10. Stand from Figure 9 (above) following fire in a typical stand following prescription A surface and ladder fuel treatment in DFPZ (alternatives 2 and 3)

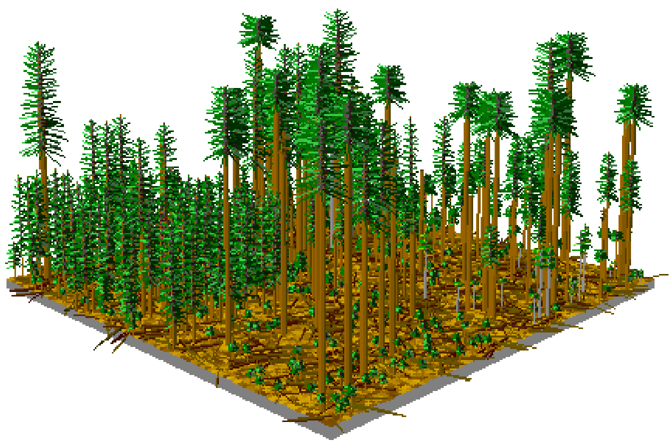


Figure 11. Three dimensional model depicting the structure and composition of surface and ladder fuels within a typical stand prior to any treatment. (This is a model of a stand that is proposed to be treated in developing a DFPZ under prescription B in both alternatives 2 and 3).

Figure 12. Model of the structure and composition a typical stand following treatment B surface and ladder fuel treatment in DFPZ (alternatives 2 and 3)

Figure 13. Model of fire behavior under 90th percentile weather in a typical stand following prescription B surface and ladder fuel treatment in DFPZ (alternatives 2 and 3)

Figure 14. Stand from Figure 13 (above) following fire in a typical stand following prescription B surface and ladder fuel treatment in DFPZ (alternatives 2 and 3)

Alternative 4

To meet desired conditions, surface fuels would be treated so that no more than 5 tons per acre of down woody material from 0-3 inches diameter would exist following all treatments. Machine piling and underburning would be implemented to treat surface fuels where necessary following tree and brush removal. Less than 10 tons/acre of down woody material would remain on site. Surface fuels loading following alternative 4 treatments are shown in Table 23.

Table 23. Down woody material surface fuel loads by the treatment areas within the Creeks II project area measured by tons/acre following prescribed treatment under alternative 4

Treatment	Surface Fuels 0-3" diameter Average	Surface Fuels >3" diameter Average	Desired Future Conditions for Fuel Loading
1	3.3	3.4	Fine Surface Fuels (0 – 3 inch diameter): Less than 5 tons per acre. Large Surface Fuels (>3 inch diameter): Less than 10 tons per acre
2	3.1	3.2	
3	4.8	3.4	
4	1.5	3.1	
5	1.6	3.3	

Source: Forest Vegetation Simulator (FVS) model outputs based on Almanor Ranger District stand exam record inputs.

Table 24 shows the number of acres of surface fuel treatments by area treatment category that would occur under alternative 4.

Table 24. Surface fuel treatments types and corresponding acres in alternative 4

Surface Fuel Treatment Type	Treatment	Acres
Dozer Pile/Pile Burn	1	128
	2	1
	4	1987
	TOTAL	**2116**
Dozer Pile/Pile Burn/Broadcast Burn	1	1060
	2	1
	TOTAL	**1061**
Grapple Pile/Pile Burn	1	196
	2	316
	3	38
	4	351
	TOTAL	**901**
Grapple Pile/Pile Burn/Broadcast Burn	1	36
	2	594
	3	915
	4	50
	TOTAL	**1595**
Mastication	1	387
	2	12
	4	400
	TOTAL	**799**
No Surface Fuel Treatment	1	7
	TOTAL	**7**
TOTAL		**6480**

Source: Almanor Ranger District GID Geo-database.

Canopy Base Height

The fire behavior potential resulting from aerial fuels can be assessed by measuring canopy base height (Scott and Reinhardt 2001). Canopy base height is defined as the lowest height above the ground at which there is a sufficient amount of canopy fuel that would be ignited from a surface fire into the canopy. Canopy base height is reported, in feet, as an average per tree for a given area. Canopy base height is a value that incorporates ladder fuels such as shrubs and understory trees. Surface fire in forested stands with canopy base height below 10 feet during extreme fire weather can result in fire extreme behavior that is difficult to suppress, including rapid spread rate and crown fire that would be hazardous to firefighters directly attacking a fire (Scott and Reinhardt 2001). Higher canopy base heights reduce the potential for crown fire initiation and spread (fire in the tree canopy) both within and outside DFPZs. For this project, the goal is to create canopy base heights at 10 feet or above and reducing surface fuels. These changes would reduce the potential for a highly intensive, stand-replacing fire. Where possible, the canopy base height should be increased to 20 feet or above which would reduce the number of entries required to meet and maintain DFPZ effectiveness for 20 years.

Table 25. Predicted canopy base height by alternative

Alternative	Canopy base Height (feet)	
	Range	Average
1	4 - 9	6
2	8 - 33	19
3	8 - 33	19
4	18 - 22	20

Alternative 1

Under alternative 1, the relatively low canopy base height shown in Table 25 creates a hazardous fuel ladder where surface fires would easily transition into crowns of trees. The dense canopies and low canopy base create a hazardous fire environment that could sustain a crown fire during fire season (Table 25). Left untreated, canopy base height values would also decrease over time with the projected ingrowth of conifers.

Alternatives 2-3

The estimated ladder fuel conditions, following alternative 2 and 3 treatments, are shown in Table 28. Currently, the average canopy base height across all stands is 6 feet (Table 25). The average canopy base height following alternatives 2 and 3 would be 19 feet. When the canopy base height is raised and surface fuels are greatly reduced, as they would be following alternatives 2 and 3 treatments, predicted flame lengths are reduced and the ability for fire to transition from the forest floor into crowns lessens. Although these treatments are effective in reducing fire behavior, the objective to raise canopy base height to 20 feet would not be met following any of the treatments within alternatives 2 or 3.

Under DFPZ, RHCA, and area thin treatments, removal of undesirable, shade tolerant trees from conifer stands would reduce ladder fuels by reducing stand density while increasing canopy base height. The proposed fuel treatments in this alternative are also effective in reducing the horizontal continuity of canopy fuels. Treatments would be effective in reducing torching during wildfire, which would further reduce the potential for a surface fire to initiate into a crown fire (Peterson et al. 2005). Where feasible, the fire-resilient pine would be retained to maintain structural diversity and contribute to multistory canopy conditions. In comparison to the shade tolerant conifers, pine are more fire-resistant (Graham et al. 2003).

In creating DFPZs, mechanical harvest treatments would remove ladder fuels in the suppressed and intermediate crown classes, which would reduce the vertical continuity between surface and canopy fuels (Peterson et al. 2005; Graham et al. 2004). Removal of understory trees would reduce stand density, ladder fuels, and shade-tolerant species, while increasing canopy base height.

In addition to thinning from below, crown thinning would also occur in stands proposed for treatment. The removal of a few intermediate and co-dominant trees would reduce stand density. The removal of interlocking crowns would increase crown spacing between residual trees, reducing the potential for crown fire continuity. Large fire-resilient dominant and co-dominant trees would be retained to maintain structural diversity and contribute to multistory canopy conditions. Species preference for retention would be given to shade-intolerant trees with more fire-resistant characteristics, such as ponderosa pine, Jeffery pine, sugar pine, and Douglas-fir (Graham et al. 2004). This treatment may reduce the spread of crown fire (Peterson et al. 2005; Graham et al. 2004), and when combined with low thinning may reduce torching.

After proposed fuel treatments are implemented, the threat of high intensity and high severity fire under moderate to extreme fire weather conditions would be greatly reduced. Furthermore, the resultant low to moderate fire behavior following treatment would increase suppression options and effectiveness, create less of a threat to the public, firefighters, and private and public property and resources.

Alternative 4

Table 27 shows that fuel treatments with this alternative would reduce fire behavior intensity while increasing canopy base height within all treatment areas. Canopy base heights would range from 18 to 22 feet. When canopy base heights average greater than 10 feet within conifer forests, a low to moderate fire environment is established (Scott and Reinhardt 2001). The relatively high canopy base height range (18 - 22 feet) creates a situation where the ability for fire to transition from the forest floor into crowns lessens, thus reducing mortality. This is a direct effect on the vegetation, but is an indirect effect on fuel conditions in regards to the fire environment.

Effects in the DFPZ and area thin units would be similar to alternatives 2 and 3, with overall treatments covering fewer acres. Thinning in conifer stands and subsequent surface fuel treatment would result in reduced aerial and surface fuel loads. The indirect effect would be to reduce hazardous wildland fire behavior from fires both originating within treatments and from outside point sources.

Removal of undesirable, shade tolerant conifer trees from forest stands would reduce ladder and aerial fuels, while increasing canopy base height. These treatments are also effective in reducing the horizontal continuity of canopy fuels (Peterson et al. 2005). In the occurrence of wildland fire these treatments would be effective in reducing torching, which would further reduce the potential for a surface fire to initiate into a crown fire.

Based on the ladder and surface fuel conditions that would result from the proposed treatments, the threat of high intensity and high severity fire under moderate to extreme fire weather conditions would be greatly reduced. Furthermore, the resultant low to moderate fire behavior following treatment would increase suppression options and effectiveness, create less of a threat to the public, firefighters, and private and public property and resources.

Flame Length

Flame length is used to represent potential fireline intensity which indicates how hard a wildfire is to suppress. Flame lengths less than 4 feet are desired to allow for safe direct attack by hand crews. Conversely, flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft. Flame lengths exceeding 8 feet promote torching, crowning, and increase the potential for spot fires.

Table 26. Predicted flame length by alternative

Alternative	Flame Lengths (feet)	
	Range	Average
1	3.5-6.3	6
2	1.2-3.3	2.2
3	1.2-3.3	2.2
4	1.2 – 2.4	1.7

Alternative 1

Under 90th percentile weather conditions, flame lengths in a wildfire would be at or above four feet in much of the project area (Table 26). Over time, as surface and ladder fuels continue to increase, fire hazard in the area would increase and the risk of large and intense fires that are difficult to control would increase. Severe fire behavior, including high flame lengths and crown fire, would create a situation where direct fireline attack would be prohibited. Such a situation would allow fires to become considerably larger and potentially more hazardous for firefighters and those communities at risk. The risk of wildfire moving into communities laying within the Creeks II project analysis area would remain high. Associated smoke from intense, severe wildfires would create both a nuisance and health concerns in these communities for considerable durations (days or weeks).

Table 26 demonstrates that predicted flame lengths in most of the treatment areas where fire behavior was modeled are near or in excess of four feet. The leading safety standard developed by the National Wildfire Coordinating Group (NWCG) is that once flame lengths exceed 4 feet, firefighters on the ground cannot directly attack fire. Equipment, such as helicopters, air tankers and bulldozers would be needed to directly attack the fire. In areas where torching occurs, flame lengths and associated fire behavior would be much higher. The existing average canopy base height in all sampled stands is 6 feet (Table 25). When predicted flame lengths are at or below 4 feet (Table 26), and the average canopy base height is low as it is, surface fire would easily transition into the crowns of trees.

Alternatives 2-3

Existing condition estimated flame lengths with proposed treatment areas range from 3.5 to 6.3 feet. Table 26 shows that after treatment, the average predicted flame lengths range from 1.2 to 3.3 feet. The threshold where firefighters could safely attack fire directly is flame lengths less than four feet, which is the desired condition for this project. Cross reference of those flame lengths with the fire suppression interpretations table in appendix B of the NWCG Fireline Handbook states that “Fires can be generally attacked at the head or flanks by persons using hand tools” (NWCG 2006). Because fires can be attacked using hand tools they are less costly to control because mechanized equipment and aerial support may be limited or unnecessary.

Alternative 4

Flame lengths would range 1.2 to 2.4 feet (Table 26). Flame lengths less than four feet would create a situation where firefighters could safely attack fire directly. Cross reference of those flame lengths with the Fire Suppression Interpretations Table in appendix B of the NWCG Fireline Handbook states that “Fires can be generally attacked at the head or flanks by persons using hand tools” (NWCG 2006). Because fires can be attacked using hand tools they are less costly to control because mechanized equipment and aerial support may be limited or unnecessary.

Fire Type

Fire type represents the intensity of the fire. Table 27 displays the type of fire that is predicted under 90th percentile fire weather conditions. Under current conditions (alternative 1), the type of fire expected within the project area would be active and passive crown fire. The type of fire expected under the same conditions for alternatives 2, 3, and 4 would be surface fire (see also Figure 15 through Figure 17).

- Surface fire is wildfire that burns in surface fuels and remains on the forest floor. Surface fires are characterized by low intensity and slow rates of spread, and are relatively easy to suppress; usually only requiring direct attack by firefighters on the ground.
- Passive crown fire occurs when surface fire transitions into the crowns of trees and individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained, except for short periods. Passive crown fires are difficult to suppress and often require mechanized or aerial support to suppress.
- Active crown fire is a crown fire in which the entire fuels complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread (Scott and Reinhardt 2001). Active crown fires are characterized by high intensity and high rates of spread, cannot be suppressed by firefighters on the ground, and require mechanical or aerial support to suppress.

Table 27. Predicted fire type by alternative

Alternative	Fire Type
1	Active Crown Fire/Passive Crown Fire
2	Surface Fire
3	Surface Fire
4	Surface Fire

Alternative 1

Under current fuel and fire conditions, predicted fire behavior during fire season within conifer stands would be relatively intense (Table 27). Over time, as surface fuels continue to accumulate and ladder fuel conditions worsen as the result of tree ingrowth, fire hazard in the area would become more extreme and the potential for large fires would increase. Severe fire behavior creates a situation where direct fireline attack is prohibited. Those situations allow fires to become considerably larger and potentially more hazardous for firefighters and communities at risk.

Table 27demonstrates that wildfire occurring under weather conditions that regularly occur several times a year in the project area would result in passive crown fire in the conifer stands. Fires occurring under hotter and drier conditions would be more likely to result in higher fire intensities. The table also demonstrates that predicted wildfire under this scenario within the treatment areas A-C would produce estimated flame lengths of 3.5 to 6.3 feet in the treatment areas that were analyzed. Cross referencing the average lengths of 4.0 with the fire suppression interpretations table in appendix B of the NWCG Fireline Handbook (NWCG 2006) states:

> Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft would be required for suppression.

Figure 15 is a map that shows predicted fire behavior within treatment areas of alternative 3 under 90th percentile weather and environmental indices under current conditions (no treatment). This maps shows that predicted fire type in most areas where treatments are proposed would be passive crown fire, with some areas experiencing active crown fire.

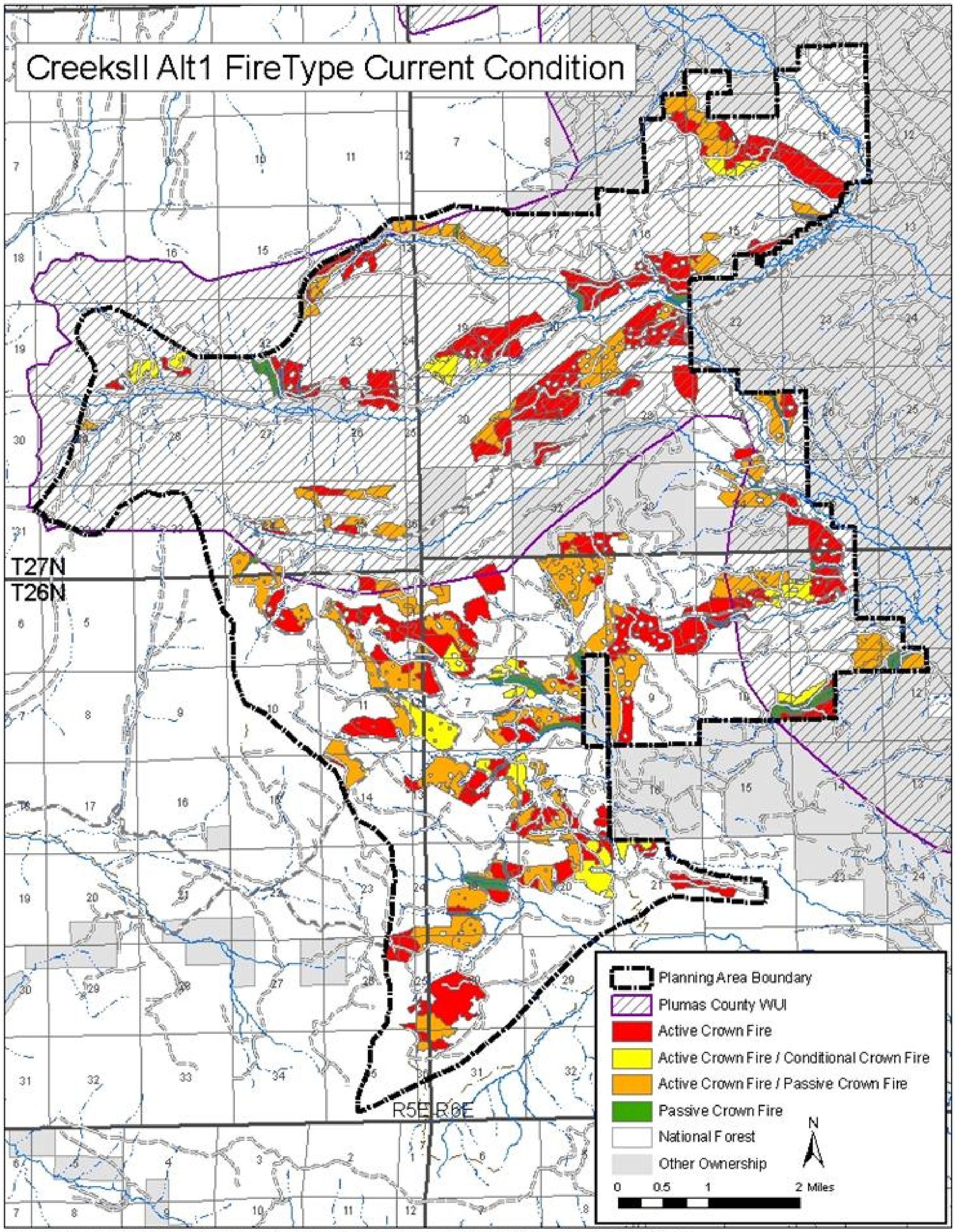


Figure 15. Predicted fire behavior within all treatment areas under 90th percentile weather and environmental indices under current conditions (no treatment)

Alternatives 2-3

Table 28 shows that post-treatment fuel conditions within treatment areas A-C would be in a far less hazardous state from a fire and fuels perspective than current conditions. Predicted fire type occurring in fire season would be surface fires. The type of fire that can be expected in all other treatment areas (D – O, RHCA) would also be surface fires. Surface fires are relatively easy to suppress with direct attack and safe for firefighter safety. Any canopy fire would be limited to individual crown fire with slow rates of spread, short flame lengths, and low intensity.

Table 28. Predicted fire type, flame lengths, and canopy base height (CBH) by the treatment areas within the Creeks II project following prescribed treatment under alternatives 2 and 3

Treatment	Existing Conditions			Alternatives 2 and 3 Post-treatment conditions			Desired Future Conditions for Fire Type, Flame Lengths, and CBH
	Fire Type	Flame Lengths[a] (feet)	CBH (feet)	Fire Type	Flame Lengths[a] (feet)	CBH (feet)	
A – DFPZ	Active Crown Fire	5.7	6	Conditional Crown and Surface Fire	3.0	15	Fire Type-Surface fires Flame Lengths- 4 feet or less CBH-20 feet or higher
B – DFPZ	Active Crown Fire	6.3	6	Conditional Crown and Surface Fire	2.6	33	
C -DFPZ	Active Crown Fire	6.1	7	Conditional Crown Fire	2.2	19	
D - Area Thin	Active Crown Fire	5.7	7	Conditional Crown Fire	2.9	24	
E - Area Thin	Active Crown/Passive Crown Fire	3.5	4	Conditional Crown and Surface Fire	3.3	8	
O - DFPZ	Active Crown/ Conditional Crown Fire	4.6	7	Conditional Crown and Surface Fire	1.2	22	
M - DFPZ	Active Crown Fire/ Passive Crown Fire	4.4	9	Surface	2.3	10	
RHCA	Passive Crown	4.2	4	Surface	2.5	10	

Source: Forest Vegetation Simulator (FVS) model outputs based on Almanor Ranger District stand exam record inputs.
a - The fire model for predicting flame lengths (FVS-FFE) used 90th percentile fire weather and environmental inputs.

Fuels treatments similar to alternatives 2 and 3 have proven to be successful in modifying fire behavior. A good example is the Cone Fire, which started on September 26, 2002 and burned 1,600 acres within the Blacks Mountain Experimental Forest inside the Lassen National Forest. When the Cone Fire started, fuel moisture and weather conditions were at levels expected to produce extreme fire behavior. Prior to the Cone Fire, 12 stands comprising 3,192 acres within the Blacks Mountain Experimental Forest were thinned from below. Following the fire, stand data was collected on both treated and non-treated units where fire had occurred. The objectives for the data collection and analysis were to, (1) quantify the differences in fire severity between the treated and non-treated areas, and (2) evaluate the effectiveness of the treatments and their potential use for future fuel reduction projects on the Forest, such as DFPZs. The thinned areas survived with an estimated 20 percent mortality, while the unthinned area experienced 100 percent mortality. These areas were all on the same aspect and slope (Skinner 2004).

Other evidence exists that support the effectiveness of open stands with fewer trees as being the most desirable result of effective fuel treatment. Graham and McCaffrey (2003) documented the effects of the Hayman Fire (Colorado June 2002) on stands that were thinned from below. The results were very similar to that reported with the Cone Fire thinning. Tree density reduction and reduced surface fuels resulted in an easily suppressed surface fire when the Hayman Fire burned into treated stands. Even though thinning opens up stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels which enhance surface fire to spread, thinning does make surface fires easier to control. By thinning from below the canopy, ladder fuels are reduced. The reduction of ladder lowers the potential for crown fire initial and spread (Peterson 2005).

The Storrie Fire (August and September 2000) located to the south of and adjacent to the Creeks II project area demonstrated how fire would likely behave in vegetation types similar to Creeks II under severe fire weather conditions. Some vegetation communities in the Storrie Fire were similar in stand structure and species composition as Creeks II. Some of these communities burned at moderate and high intensities and were severely damaged, with entire stands of trees killed as a direct result of fire-related injuries. We are assuming that a fire in the Creeks II area under current conditions and similar weather would experience moderate to high intensity fire (Figure 15). Figure 16 is a map that shows predicted fire behavior within all treatment areas under 90th percentile weather and environmental indices following alternative 3 treatments.

When contrasted with Figure 15, which shows the predicted fire type under current fuel conditions, Figure 16 shows a very different picture of predicted fire behavior following surface and ladder fuel treatments in alternative 3. Figure 15 shows that the type of predicted fire during extreme fire weather would be either passive or active crown fire. Figure 16 shows that the type of fire that is predicted after treating surface and ladder fuels would be surface fire.

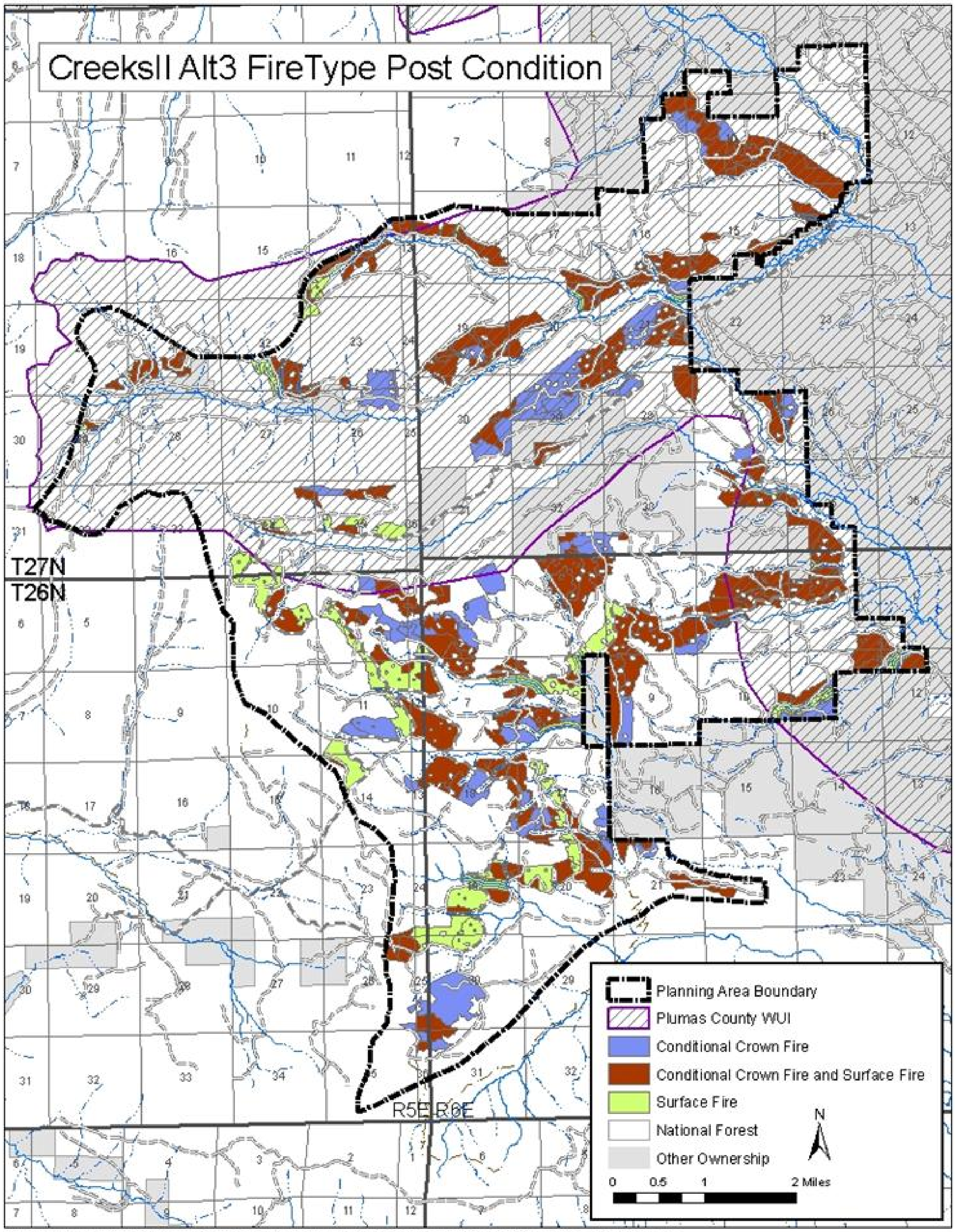


Figure 16. Predicted fire behavior within all treatment areas under 90th percentile weather and environmental indices following alternative 3 treatment

Alternative 4

The direct effects in the DFPZ and area thin units would be similar to those of alternatives 2 and 3. Removal of undesirable, shade tolerant conifer trees from mixed conifer stands would reduce ladder and aerial fuels, while increasing canopy base height. These treatments are also effective in reducing the horizontal continuity of canopy fuels. Treatments would be effective in reducing torching during wildfire, which would further reduce the potential for a surface fire to initiate into a crown fire. Table 29 and Table 23 show the estimated fire type, flame lengths, canopy base height, and surface fuel loading that would be the result of alternative 4 treatments.

Table 29. Predicted fire type, flame lengths, and canopy base height (CBH) by the treatment areas within the Creeks II project following prescribed treatment under alternative 4

Treatment	Existing Condition			Alternative 4 post- treatment conditions			Desired Future Conditions for Fire Type, Flame Lengths, and CBH
	Fire Type	Flame Lengths[a] Average (feet)	CBH Average (feet)	Fire Type	Flame Lengths[a] Average (feet)	CBH Average (feet)	
1	Active Crown Fire	5.7	6	Surface/Conditional Crown Fire	2.9	19	Fire Type- Surface fires Flame Lengths-4 feet or less CBH- 20 feet or higher
2	Active Crown Fire	5.4	6	Surface/Conditional Crown Fire	1.2	22	
3	Active Crown Fire/Conditional Crown Fire	5.5	9	Surface/Conditional Crown Fire	1.3	18	
4	Active Crown Fire/Passive Crown Fire	4.6	11	Surface Fire	2.4	20	
5	Active Crown Fire/Passive Crown Fire	4.3	4	Surface Fire	2.4	19	

Source: Forest Vegetation Simulator (FVS) model outputs based on Almanor Ranger District stand exam record inputs.
a - The fire model for predicting flame lengths (FVS-FFE) used 90th percentile fire weather and environmental inputs.

The predicted fire type would be surface fire within all treatment areas (Table 29 and Figure 17). Following the proposed treatments, the fire environment would be significantly less hazardous and allow firefighters to directly attack a wildfire. Figure 17 shows the predicted fire behavior within all treatment areas under 90th percentile weather and environmental indices following alternative 4 treatment.

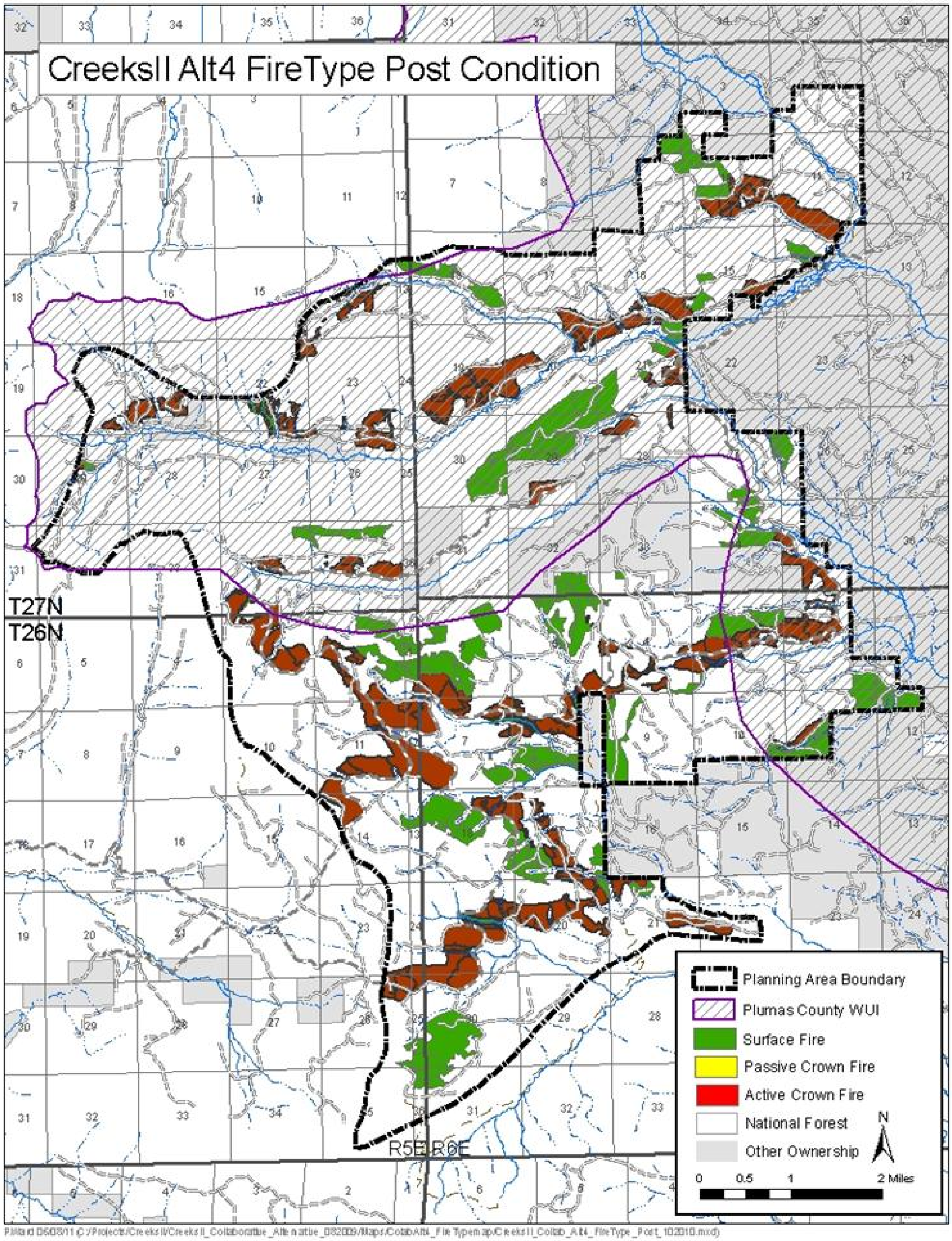


Figure 17. Predicted fire behavior within all treatment areas under 90th percentile weather and environmental indices following alternative 4 treatment

Prescribed Fire and Pile Burning

Two methods of prescribed burning would be used to accomplish fuel load reduction: underburning and pile burning (piles created by machine and by hand). Underburning would be used to reduce both natural and activity-generated fuels where it is neither cost effective nor physically practical to pile and burn. The objective of underburning would be to reduce fuel loadings while protecting the residual overstory trees from damage caused by heat, flames or equipment. Pile burning would produce less particulate matter per acre than underburning because piled material can be ignited with lower fuel moistures, which ensures complete and efficient consumption.

Residual Vegetation

Alternative 1

No prescribed fire or pile burning would be implemented under alternative 1.

Alternatives 2-3

Under prescribed burning, fire would prune trees, thereby raising the canopy base height. Prescribed fire would also reduce surface and ladder fuels. Machine and hand pile burning would not have the same effects on vegetation as underburning. The raising of the heights of the crowns would not occur from pile burning. There could be some scorching of low branches due to heat and flames from burning piles, but this would occur only in isolated patches.

Table 30. Fire effects on tree and shrub species

Ponderosa pine	Ponderosa pine is adapted to fire. It has thick bark, medium to large size buds, long needles, open crown structures, and becomes resistant to fire at the sapling to pole size. Burning would be conducted in this project area in the spring, early summer, and fall. There would be some scorching of the crowns resulting from the underburning of the stands. An effect of the scorching would be the pruning of the lower branches thus raising the crowns of the trees. This raising of the heights of the crowns would make it harder for crown fire initiation.
Douglas-fir	Douglas-fir can survive moderately intense fires. It has thick corky bark on the lower bole and roots that protect the cambium form damage. Seedlings and saplings are susceptible to and may be killed by even low-intensity ground fires.
Sugar Pine	Mature sugar pine is very resistant to low to moderate severity fires. It has adapted a thick, fire resistant bark and open canopy that retards aerial fire spread. Young sugar pines are susceptible to low to high severity fires.
White fir	Sapling and pole size white fir are sensitive to fire due to the thin bark, low growing branches, and shallow roots. As the trees mature, the bark becomes thicker and is able to resist fire.
Incense-Cedar	Seedlings and sapling size incense-cedar are readily killed by fire. In studies conducted in northern California a low severity fire killed nearly all seedlings and saplings. Mature incense cedar's thick bark offers sufficient protection from excessive heat. Most studies find that only a high intensity surface fire would kill an occasional mature incense cedar.
Red Fir	Seedlings of red fir are easily killed by fire. Low intensity fires kill seedlings and saplings of red fir. The bark of older red fir is thick and fire resistant. The needles and branch tips are resistant to fire. Larger California red fir is able to withstand low severity fire but area killed by high severity fires.
Black Oak	California black oak has adapted to fire by sprouting from the root crown. Further fire adaptations include an extensive root system capable of supporting vigorous sprouting, and seedbed requirements (mineral soil or light duff) matching those produced by light- or moderate-severity fire.
Greenleaf Manzanita	Greenleaf Manzanita is adapted to fire. It has volatile oils in its leaves, low moisture in its leaves in the summer, and persistence of dead branches and stems. Sprouting from the root burl follows burning of the plant. In some areas, sprouting occurs from seed source in the soil after scarification has occurred.
Ceanothus	Ceanothus species are adapted to fire. Seeds retain their viability for several years and following a fire to scarify the seeds, they would sprout. The plant also has the ability to sprout from the root crown, if there is no damage to the root crown from fire.

Prescribed pile burning may result in mortality of individual or isolated pockets of trees, but generally no more than five percent mortality of small diameter trees (1-5 inches). This effect is expected to be minimal throughout all stands. Emerging vegetation may be dependent on consumption of some surface fuels, primarily the duff and litter layers within and adjacent to piles. Pile burning is expected to remain low in intensity. The tree and brush species that are adjacent to piles could be affected by prescribed fire in a variety of ways. The summary of these effects is described in Table 30 (Brown and Smith 2000).

All species listed in Table 30 would be subject to prescribed fire pile burning within the Creeks II project area. The table demonstrates that pile burning could result in some mortality of white fir, incense cedar, and Douglas-fir seedlings. The low intensity pile burning would also result in some mortality of sugar pine seedlings/sapling.

The effects of pile burning would be negligible inside of RHCA inner zones, as material would be removed and piled outside of those areas. Pile burning close to some trees may induce crown and cambium scorch (living tissue underneath the bark) on nearby residual trees. However, incurred mortality as a result of pile burning would be negligible. Understory vegetation would not be affected, with the exception of localized areas where duff and litter would be consumed during pile burning. Even in these localized areas, the understory vegetation would regenerate, and the effects would be short term.

Alternative 4

Effects of prescribed fire and pile burning units would be similar to alternatives 2 and 3, with overall treatments covering fewer acres.

Prescribed fire treatments may result in mortality of individual or isolated pockets of trees; however, this effect is expected to be minimal throughout all treated stands. Establishment of understory vegetation may be dependent on consumption of the surface fuels (primarily the duff and litter layers), canopy cover, and stand characteristics. However, low-intensity prescribed fire is not expected to create large shifts in forest species composition and structure. Fire would prune trees, thereby raising the canopy base height. Prescribed fire would also reduce surface and ladder fuels. Machine and hand pile burning would not have the same effects on vegetation as underburning. The raising of the heights of the crowns would not occur from pile burning. There could be some scorching of low branches due to heat and flames from burning piles, but this would occur only in isolated patches.

Air Quality

Prescribed fire is one of the primary activities proposed for the Creeks II project that would have a direct impact on air quality. A secondary source of impacts on air quality would be from dust and internal combustion engine emissions during project harvest, mastication, and road construction activities.

This is a summary of air quality impacts. Greater detail in included in the fuels report located in the planning record.

Alternative 1

No prescribed burning or pile burning would occur under alternative 1so there would be no impacts from these activities. However, the risk of high intensity wildfire is greater under this alternative. Smoke and particulate matter emissions from a high-intensity wildfire would be extreme in both density and duration. The 2000 Storrie Fire and the 2008 Cub/Onion Fire Complexes, all in proximity to the Creeks II project area, impacted the Lake Almanor Basis with heavy smoke for several weeks.

Alternatives 2-4

The project area lies within the Plumas and Butte County Air Pollution Control Districts (ACPD). As a matter of regional policy, a smoke management plan would be submitted to and approved by involved agencies prior to any burning that would occur within the Creeks II project area. Several communities lie within proximity of the areas where both pile and prescribed burning is proposed to occur. Adherence to the smoke management plan for pile and understory burning would alleviate negative impacts to communities.

The prescribed burning proposed in all action alternatives would be used to reduce fuel loadings to an acceptable level. Under favorable smoke-dispersal conditions, the smoke would likely affect air quality during ignition and for approximately three days following ignition. Another impact of all action alternatives would be the emissions and dust caused by project activities. Emissions from burning and equipment used for other project activities (such as thinning and mastication) may be occurring at the same time, which would elevate PM. By adhering to a smoke management plan approved by the Lassen National Forest Supervisor and the Northern Sierra Air Quality Management District, particulate matter emissions from pile or understory burning would comply with California Ambient Air Quality (CAAQ) emission standards.

Treatment of fuels under alternatives 2 -4 could result in decreased smoke production and associated particulate matter that could result from a wild fire.

Cumulative Effects

Analysis Area

The cumulative effect analysis area for the Creeks II project includes ten subwatersheds. Those sub-watersheds are; Fanani, Grizzly Creek, Humbug Valley, Lemm Hollow, Marian Creek, Ruffa, Shanghai Creek, Soda Creek, Soldier Creek, and Upper Yellow Creek. The watershed boundaries make a logical perimeter for the area of analysis because they contain the project and generally prohibit effects from outside sources. Generally fires slow when burning into ridge tops which often mark watershed boundaries. These boundaries are a good place to take a stand in fighting wildfire either by aerial attack, indirect line, and/or backfiring.

Past and Foreseeable Actions

Past and foreseeable actions for the Creeks II analysis area are described in appendix E.

Specific potential future actions related to fire include:

- There would be the continued potential for ignitions by recreational users (campers, miners, hikers, hunters, OHV users, and others). Implementation of alternatives 2 and 3 would enhance fire management's ability to contain, control, and suppress these ignitions, particularly in fuel treatment units.
- The continued removal of roadside snags by commercial and "personal use" fire wood cutters would decrease the chance of snag-related injuries, spotting, or snag fall over fire lines at points of snag removal.
- Other activities (such as special use permits) may increase the potential for human ignitions from maintenance personnel and equipment. Special uses (such as antennas, power lines, microwave lines, or other related infrastructure) might receive priority for protection during large wildfires.
- Slash and potential slash-related fire hazards resulting from past treatments on National Forest lands may be reduced by implementation of alternatives 2 and 3, particularly where slash is encountered in proposed fuel treatment units.
- Implementation of alternatives 2 and 3 would enhance fire management's ability to contain, control, and suppress fires spreading from private onto public lands within the Creeks II project area, particularly in fuel treatment units.

- Future fuel treatment maintenance activities could enhance the longevity and effectiveness of these treatments. These activities along with other past, present and foreseeable fuels treatment on both private and Forest Service lands in the Creeks II analysis area would cumulatively and positively impact the environment by improving current fuel conditions, which are currently in a state of fire hazard. This conversion would further benefit resource values, property, and people, while creating fuel breaks where reduction in wildland fire resistance to control would benefit the safety of firefighters.

Cumulative Effects

Alternative 1

Alternative 1 would not reduce surface ladder and crown fuels or break up fuel continuity within mixed conifer stands throughout the project area. It would not alter the fuels condition in a way that minimizes fire behavior or its detrimental effects; therefore, there would be no beneficial cumulative effect in regard to forest fuels or fire behavior. A considerable portion of the project area would remain at high risk for passive crown fire and would be more vulnerable for stand-replacing wildfire under extreme conditions.

The natural fire regime of the fire-adapted systems within the Creeks II project area is one of periodic, short-term interval fires, ranging from 2 to 15 years (Beaty and Taylor 1997). Continued exclusion of fire in this area would exacerbate the threat for potential stand replacing wildfires. The present, short term, and long-term effect of not using prescribed fire or burning piles would be that surface, ladder, and aerial fuels would continue to become more excessive in load, thus creating an even more hazardous fire environment than what currently exists. While no prescribed burning would occur under this project, prescribed and pile burning is planned to occur on other projects both on National Forest System and private lands within the analysis area. Short duration production of smoke and associated emissions would occur during pile and understory burning. By adhering to smoke management plans approved by the Northern Sierra Air Quality Management District, all emissions standards would be met for California Ambient Air Quality (CAAQ) standards.

Alternatives 2 -4

The cumulative effect of the proposed treatments would be an increase in the capacity to manage forest health and fire potential and achievement of some objectives of the National Fire Plan, the 2004 Sierra Nevada Forest Plan, and the Healthy Forest Restoration Act. The proposed treatments would reduce fire hazard and increase firefighter safety by improving surface and aerial fuel conditions while extending the fuel-break network. The fuel treatments would create a relatively open forest structure where fuel amounts and arrangements have been altered to encourage low-intensity surface fires, which may be effectively suppressed by fire management personnel. The intensity and frequency of fuel treatment maintenance activities may have an inherent effect on the establishment and development of understory vegetation and tree regeneration. This, in turn, would retain stand structure and composition and would influence the long-term effectiveness in fuel treatments in terms of understory establishment and development. Fuel treatments would help provide continuity between existing wildland-urban interface (WUI) fuel treatments, as well as enhance the effectiveness of work that would be completed or implemented in the future (either privately or through other sources).

The historic fire regime within the Creeks II project area is one of periodic, short-term interval fires, ranging from 2 to 15 years (Beaty and Taylor 1997). Inclusion of fire in this area would reduce the hazard of the fire environment. The present, short term and log-term effect of using prescribed (pile burning) would be that surface fuels and some ladder fuels would be reduced, thus creating a less hazardous fire environment than what currently exists. Prescribed pile burning is planned through alternatives 2-3. Prescribed and pile burning is also planned to occur on other projects both on Forest service and private lands within the analysis area listed in Appendix C. By adhering to a smoke management plans approved by the Northern Sierra Air Quality Management District, particulate matter emissions cumulative pile or understory burning would not violate California Ambient Air Quality (CAAQ) emission standards in the analysis area. Short duration production of smoke and associated emissions would occur during pile and understory burning.

Silviculture

Introduction

This section provides the scientific and analytical basis for comparing alternatives as they relate to changes both in vegetation and associated effects and forest product outputs that contribute to community and project economics. This analysis is based on field inventories and reconnaissance from 1994 through 2010. Post treatment stand conditions are based on modeling using the Forest Vegetation Simulator program, a growth model used to predict stand development, and project stand data. Details of specific methods used for analysis are described in the silviculture report located in the planning record. All data used for analysis is documented in the planning record.

Management Direction and Laws

Forest Plan direction is considered for each alternative as it relates to the intent of the 1993 Lassen National Forest Plan, as amended by the 1999 ROD for the HFQLG Act FEIS and the 2004 ROD for the SNPFPA FSEIS, the National Fire Plan, or the Healthy Forest Initiative

Alternative 1would not meet the intent of the Forest Plan. There would be no shift towards historical species composition, no reduction in dense stand conditions, and no diversification of landscape structure. Stands would remain dense with shade tolerant small trees which would contribute to higher fuel loadings and lower canopy base heights. These factors would increase the risk of more intense fire behavior including higher flame lengths, increased torching into crowns and increased mortality of vegetation. Public and firefighter safety would continue to be jeopardized from the existing conditions in the event of a wildfire.

Alternatives 2-3 would meet the intent of the Forest Plan. There would be a shift towards historical species composition, there would be a reduction in dense stand conditions, and diversification of landscape structure would increase. Density of shade tolerant small trees which contribute to higher fuel loadings and lower canopy base heights would be substantially reduced. These factors would reduce the risk of more intense fire behavior. Should a wildfire occur public and firefighter safety would be improved as well as the ability to control the fire for a period of up to 20 years.

Alternative 4 would meet the intent of the Forest Plan. However, alternative 4 does not fully meet all opportunities to reduce stand density and improve tree vigor and overall forest health as stated by the Regional Forester in the 2004 ROD for the SNPFPA, Stand diameter limits designed only for fuels reduction purposes would not allow thinning throughout diameter classes to fully achieve forest health objectives. In addition, due to diameter limits, there would not be as much of a shift towards historical species composition and diversification of landscape structure would not increase. Density of shade tolerant small trees which contribute to higher fuel loadings and lower canopy base heights would be substantially reduced. These factors would reduce the risk of more intense fire behavior. Should a wildfire occur, public and firefighter safety would be improved as well as the ability to control the fire for a period of up to 20 years.

National Forest Management Act (NFMA) Compliance

The silviculture treatments developed for the proposed action address timber stands (lands) that are suited for timber production and comply with 36 CFR 219.14 (Timber Resource Land Suitability). No harvesting would occur on lands designated as off base or deferred, which include spotted owl protected activity centers, wilderness and designated roadless areas. The proposed vegetation manipulation of tree cover, as recommended by the treatments, comply with 36 CFR 219.27(b)(1)-(b)(7) and are consistent with the multiple-use goals and standard and guidelines established in the Lassen National Forest Plan, as amended. Necessary actions would be implemented to ensure the successful regeneration of shade intolerant pine and aspen species within group selection openings. Treatment areas were not chosen because they would generate the greatest amount of dollars or timber output. The analysis discloses the effect of proposed treatments on residual trees and prescribes specific protection measures as integrated design features. Best Management Practices (BMPs) would be followed so there would be no permanent impairment of site productivity as a result of this project. The rate of soil erosion would not increase as a result of these actions (see watershed and soils portion of this chapter). Standard operating procedures along with specific design features are incorporated to protect wildlife habitat, aesthetic, and other resource values. Species habitat and viability would be maintained. Harvest plans are practical in terms of transportation and harvesting requirements, and total costs of preparation, logging, and administration.

Restocking Within Five Years

All stands proposed for silvicultural treatment under the action alternatives can be adequately restocked within five years of final harvest. Stands in the vicinity with comparable site conditions have received similar silvicultural treatment and resulted in full stocking within five years of final harvest.

Methodology

Scope of Analysis

Vegetation

The analysis area for direct, indirect and cumulative effects is the project boundary which is approximately 32,463 acres. The geographic analysis boundary was designed to be bounded by major topographical features including ridgetops and drainages. These features were incorporated as they influence fuelbreak effectiveness in the case of a wildfire. Incorporating proposed treatment areas and topographical features allows for landscape level analysis of the relations between vegetation, fire and fuels. Ecologically, the dynamics between vegetation and fire and fuels are linked. Vegetation treatments have profound effects on fuel loading and fuel arrangement, which influence fire behavior. Fire, in turn, has a profound effect on vegetation establishment and development.

The temporal scale for this analysis is based on current cumulative vegetation conditions. It is assumed that the current vegetation conditions are the sum of all past actions that have occurred within the analysis area. In a broader sense, current vegetation structure and composition reflects the historical management regimes. This vegetation structure and composition includes attributes of the current landscape including existing vegetation types, fuel treatments, burned areas, past harvest, and plantations. See appendix E for a list of specific past, present, and foreseeable future actions.

The temporal boundary of the vegetation effects analysis extends 20 years into the future. Vegetation establishes itself and grows rapidly on the western slope of the northern Sierra Nevada in the Lassen National Forest due to annual precipitation and highly productive forest soils. Within this timeframe, vegetation generally has sufficient opportunity to increase canopy closure, basal area, and tree density to a point where subsequent thinning would be needed again to maintain stand vigor, health and growth. This timeframe is also expected to encompass the time period for DFPZ effectiveness (approximately 20 years). To increase heterogeneity by creating a range of age classes, additional group selections could be placed in each stand within 10-20 years of implementation as trees planted within the group selection areas proposed within the Creeks II project would average 8-20 feet tall in 10 to 20 years. It is important to note that unknown or unanticipated wildfires, disease outbreaks, or mortality may occur in the analysis area within the 20 year timeframe – these potential future events are not included as part of this analysis.

Cumulative Effects

The area considered for silviculture cumulative effects is the project area. This area was chosen because stand growth and development is primarily dependent on site conditions such as soils, elevation and precipitation. Stand and site conditions elsewhere (outside of the treated stands) generally have little effect on treated stands, with the exception of effects on forests insect populations. Activities and management since 1975 within the project area are considered in this analysis because the effects of the past silvicultural treatments are still occurring (i.e. Improved health and vigor of thinned stands, regeneration of clearcuts, establishment of pine stands). Management activities and events prior to this are considered in this analysis in so far as they have shaped current stand structure conditions.

The existing stand conditions are the result of past management and treatments that include logging, fuelwood harvest, grazing, fire suppression, and tree planting. Stand structure has changed since settlement of the project area in the 1800s. Prior to European settlement of the western US, large trees characterized Sierran forests, relatively open understories with only occasional ladder fuels (Verner and McKelvey 1994).

Fire suppression and to a lesser extent, grazing have resulted in an increase in the number of small diameter trees. Grazing and its associated soil disturbance provide suitable soil conditions for seedling establishment. Logging disturbance also creates canopy openings and scarifies the soil, which can lead to seedling establishment. Periodic wildfires, which could have consumed some of the small trees, have been suppressed. Forests of the Sierra Nevada, including the project area, have developed fuel ladders, accumulations of surface fuels, and there has been an increase of shade-tolerant conifers such as white fir and incense cedar (Verner and McKelvey 1994) in the forest understory. Since 1945 there has been an increase in the true fir type and a comparable decrease in the pine type in Sierra Nevada forests (Beardsley and Warbington 1999). This is true of the Creeks project area as well.

Measurement Indicators

The measurement indicators for potential treatment effects on vegetation include tree species composition, stand density and structure, forest health, landscape age class distribution, as well as economic and social effects of vegetation treatment and are described below: The effects of the Creeks II project on vegetation as it relates to these indicators are summarized in this section.

Tree Species Composition

Species composition is the percentage of species within individual stands as well as dominant vegetation types in stands across the landscape. Species composition of a forested stand is a direct measurement of species diversity. Effects are measured by the impact treatments have on reaching the desired species composition within the Creeks II project.

Desired condition

One project objective is to increase the pine component. This would require increasing the percentage of pine found as a species in the project area which would in turn help increase overall species diversity. In order to promote species diversity shade intolerant species such as pine must be healthy and have the appropriate environment to be able to proliferate. Openings in a forested stand allow shade intolerant trees such as pine to proliferate. The resulting seedlings that become established in the openings add a different age class and size, contributing to overall stand structure which is an additional project objective common to all proposed treatments.

Landscape Age Class Distribution

Landscape age class distribution is an indicator used to measure cumulative effects to vegetation across the project area. It is measured by calculating the distribution of relative seral stages on the landscape.

This indicator represents a stand's vertical profile. The percent change of seral stage and canopy density proposed by treatments is calculated to measure change on the landscape structure.

The distribution of seral stages may be used as a measure of landscape diversity. California Wildlife Habitat Relationship (CWHR) vegetation type size and density class is used as a proxy for seral stages to calculate the distribution of relative seral stages. CWHR classification represents dominant stand characteristics across the landscape. This allows for analysis of effects on forest vegetation in combination with wildlife habitat.

Desired condition

Increasing forest age class diversity in turn increases heterogeneity. Increased heterogeneity is important for several project objectives such as fuel reduction and wildlife habitat. Also, the Lassen Forest Plan states to provide at least five percent of the acreage of each vegetation type that occurs within a management area in each seral stage.

The distribution of forest age class in the Creeks II project area consists primarily of young and middle-aged forests of small to medium size trees that are in early to mid seral stages. Increasing and enhancing the rate of development of late seral would improve both present and future landscape age class diversity. Early seral develops in to mid seral at an increased rate on good growing sites such as those found in the project area creating a constant need to increase early seral in order to maintain landscape diversity. Several project objectives identify the need to increase both early and late seral stages to enhance landscape heterogeneity.

Stand Density and Structure

Measurement of stand density is a very useful tool to predict present or future susceptibility of a stand to drought-related or insect-caused mortality. The stand density index (SDI) is a quantitative measurement that takes into account number of trees and total basal area of a stand, and equates them to a standardized numeric value, or stand density index. This numeric value can be used to compare different stands and different treatments.

The density of a stand is ultimately limited by resources such as soil moisture and growing space. Research has shown that when a stand approaches 60 percent of the stand's maximum stand density index, the inter-tree competition for resources and the risk of mortality from insect, disease, and drought begin to increase (Oliver 1995; Simonson 1998; Cochran et al. 1994). All stands are continually growing and moving toward a maximum stand density index. This maximum can be thought of as the stand's biological limit.

Stand structure is analyzed using trees per acre and their distribution by diameter class. Basal area and canopy cover are also measures used to analyze density and structure. The number of trees per acre and their distribution by diameter class, basal area, and canopy cover provide insight into number, size and positioning of trees vertically and horizontally within a stand. These attributes are applied to the understory, mid-story and overstory layers to determine the average vertical profile within individual stands.

Desired Condition

Desirable stand densities range between 35 - 50 percent of maximum stand density index. At these density levels stands sufficient growing space and site resources are available such that inter-tree competition does not largely impact individual tree and stand growth. At these initial densities, inter-tree competition does not severely impact stand growth for a period of generally 20 years or more. Lower densities (nearer to 35 percent of maximum stand density index) are desirable for younger stands because they grow more vigorously and individual trees can capitalize on available resources. Lower densities are also desirable to promote healthy regeneration, particularly openings for pine regeneration. Densities between 35 - 50 percent of maximum stand density index and less represent fairly open grown stands where trees are able to utilize all of the available site resources and have room to grow.

A common objective of all proposed treatments, (except for Riparian Habitat Conservation Areas which utilize Riparian Management Objectives), is to maintain stand density index below or close to 60 percent of maximum stand density index for 20 years as a means to improve tree vigor, growth, and disease resistance and to limit the need for re-entry. Desired stand structures may vary with individual stands across the landscape depending on management objectives.

Affected Environment

Existing Condition

As a result of fire suppression, past timber harvest, and grazing, to varying degrees, forest structure and composition in the Creeks II project area has changed from being dominated by large, old, widely spaced trees (with a much higher proportion of pine) to dense, even-aged stands of white fir. Most of the dominant and co-dominant trees are approximately 80-100 years old, which roughly coincides with the beginning of fire suppression on the National Forests in 1905. Large, remnant predominant Jeffrey, ponderosa, and sugar pine trees (>30 inches in diameter) remain but they are generally widely scattered and comparatively small in number. Large pine stumps are also present, providing evidence of past species composition. These remaining trees provide structural diversity and are an important seed source. See additional discussion of historical conditions under chapter 1, condition of the project area.

Conifer encroachment has resulted in a loss of aspen, an important riparian species. An aspen clone consists of numerous stems that are genetically alike and began from a single seed that germinated sometime in the past. These clones have been perpetuated on site by disturbance, which allowed the clones to survive and expand. Since European settlement, the natural disturbance regime, usually fire, has been interrupted. This has caused many sites once dominated by aspen to succeed to conifers.

One of the factors associated with climate that directly contributes to mortality in any local plant community is soil moisture availability. With the greater the biomass (amount of vegetation), the greater the amount of water needed to support the vegetation. This becomes critical in times of drought. Guarin and Taylor (2005) found that mortality began to increase after two consecutive years of drought and correlated with the amount of rainfall and the amount of snowpack. If current predictions are correct, declines in late season soil moisture due to reduced snow pack or snowpacks melting earlier in the season, could cause conditions similar to a drought.

The gradually warming temperatures that have been recorded over the last several decades (Westerling et al. 2006) are expected to play a part in creating late season drought-like conditions. A recent review of climate (Ryan and Archer 2008) indicates that “along with a general warming trend, the length of the northern hemisphere growing season has been increasing”. The warming appears to have been generally increasing for some time. (USGS 2005). Over the last century, spring and early summer flows have declined from being over 50 percent of the runoff to 40 percent, indicating that snowmelt is occurring earlier on average. This results in lower soil moisture earlier in the season, reducing the amount of water available for plants during the mid and late summer and fall.

The climate predictions for the northern sierras over the next few decades generally indicate that precipitation will remain “normal” or may actually increase but more of it will come as rain (USGS 2005). However, with an increase in temperatures and extended length in growing season (Ryan and Archer 2008, USGCRP undated www.globalchange.gov) the effect would be similar to drought conditions where soil moisture is low, increasing plant stress. The change poses several increasing risks to today’s forests. Westerling et al. (2006) looked at wildfire trends and climate and found that the frequency of large wildfire and fire season length has been increasing since 1985. The changes were closely linked with the timing of snowmelt .Wildfire can inflict large areas of high mortality.

The Cub Fire which occurred north of the project area in 2008 was reportedly a low to moderate intensity fire. After the fire, we mapped fire intensity based on impacts to soils and vegetation. In 2009, we compared the burn area mapping to aerial photos which showed that in most cases even the moderate intensity fire resulted in nearly 80 percent or greater mortality. We also found that mortality continued well into 2009, even in areas that appeared unaffected by the fire. One likely explanation for the continued mortality is that trees were stressed from a previous dry year and dry spring but also the fire, even at low to moderate intensity caused damage to the trees' cambium and fine root hairs responsible for providing water and nutrients.

Other forest risks that may be on the increase in the future are insects and diseases affecting trees. A risk assessment conducted by the USDA (2007b) indicates that within the Sierras, including the project area, are at a moderate to high risk from insect and pathogens. These forests appear to be unstable and are highly susceptible to drought-induced mortality, as competition for water weakens trees particularly on drier sites, increasing the risk for epidemic bark beetle infestations and potential wildfire.

Project Area Covertypes

Forest and non-forest covertypes within the Creeks II project analysis area are displayed in. The following vegetation types characterize forested stands within the Creeks II project area. Red fir stands occupy the highest elevation and north aspects. Mixed conifer and ponderosa pine occupy the lower, dryer sites. White fir stands generally occur generally within mid-elevation areas between the mixed conifer and red-fir types and are often found mixed with both pine and red fir. Mixed conifer stands generally have large numbers of shade tolerant white fir and incense-cedar in the understory and mid-story; and scattered, mostly light to moderate stocking of large diameter overstory pines.

Table 31. Project analysis area forest and non-forest covertypes

Cover Type	Acres	%of Project Area
National Forest		
Lodgepole pine	12	<1
Mixed Conifer	17,012	52
Ponderosa pine	427	<1
Jeffrey, ponderosa, sugar pine	161	<1
White fir	5,314	16
Red fir	5,461	17
Subtotal Forest Cover Types	**28,387**	**87**
Non-Forest, Private/State Lands		
Shrub/Hardwood (Montane & Mixed Chaparral)	368	<1
Meadow	290	<1
Riparian	499	1
Barren (rock , gravel, soil)	243	<1
Private/State	2,676	8
Total Project Area	**32,463**	**100**

Source: Almanor Ranger District GIS (Vestra Veg Updated for Project Area)

Openings created by natural disturbance that are favorable for shrub species are limited on National Forest System lands within the Creeks II project area. Existing openings are primarily the result of past management practices; and large open areas with shrubs are generally declining as a result of conifer growth. Chinquapin and greenleaf manzanita are the predominant understory brush species. Associated species include snowbrush, deer brush, bitter cherry, gooseberry, and squaw carpet.

Table 31 reflects acres of each vegetation type as well as private ownership identified for the entire project area.

Tree Species Composition

Shade intolerant ponderosa pine, Jeffrey pine, and sugar pine average to 4 to 8 percent of the total trees per acre in the Creeks II project area, a component well below the historical average. The species composition of forested stands will continue to shift toward shade tolerant species such as red fir, white fir, and incense-cedar ultimately reducing opportunities for shade intolerant species such as pine (ponderosa, sugar, and Jeffrey) and Douglas-fir to proliferate without management treatments.

Aspen occurs as a component of other stands. There are no stands classified as aspen within the project area and are generally included in montane riparian (MRI) vegetation types. Aspen occur both within and outside of mapped riparian vegetation areas and are typically overtopped by conifers and appear to be in decline. Aspen is shade intolerant and needs full sunlight for successful establishment and growth. Aspen regeneration is spotty and generally limited to small openings where sunlight reaches the ground.

Landscape Age Class Distribution

Present forest age class consists almost exclusively of young and middle-aged forests of small and medium-sized trees that are in early to mid seral stages. Table 32 shows age class distribution as delineated by CWHR size classes across the project area.

Stand Structure and Density

The predominant California Wildlife Habitat Relationships (CWHR) size class of forest stands in the project area is 4, which equates to an average stand diameter between 11-23.9 inches d.b.h. approximately 79 percent of the forest stands are in size class 4. Approximately 69 percent of forest stands have moderate to dense canopy cover ranging from 40 percent to 100 percent cover, which corresponds to CWHR canopy classes “M” (40 percent to 59 percent canopy closure) and “D” (60 percent to 100 percent crown closure).

The CWHR canopy class “M” and “D” stands are either at or approaching maximum stand density levels. Maximum stand density occurs when all site resources are being used by the stand, such that additional growth cannot occur without some tree mortality to free up resources, particularly water and growing space. At densities between 60 percent and 70 percent of maximum, tree growth and vigor is severely impacted by inter-tree competition. As stands exceed 60 percent of maximum stand density index, they grow at increasingly slower rates as trees are stressed for resources. Individual tree mortality occurs throughout a stand at these densities often due to a combination of factors. Stands may persist at these levels for years; however, they are prone to large scale insect and disease outbreaks, and stand replacing fire because of their stressed condition and density (Ferrel 1986). Drought events can exacerbate this condition and lead to widespread mortality as well.

Of the stands modeled, ninety five percent of the CWHR canopy “D” stands were above 60 percent of maximum stand density index. About half of the modeled CWHR canopy “M” stands were at or above 60 percent of maximum stand density index.

Table 32 shows the distribution of CWHR size and canopy classes of the forest cover types on National Forest System lands (NFS lands) in the project area.

Table 32. Project analysis area CWHR classes (pre treatment)

Forest Cover Type	CWHR Class - Acres in Project Area, Pre Treatment																	
	Seed-ling	**Sapling (1" - 5.9 inches d.b.h.)**				**Pole (6" - 10.9 inches d.b.h.)**				**Small (11" - 23.9 inches d.b.h.)**				**Medium/Large (> 24 inches d.b.h.)**				
	1	**2S**	**2P**	**2M**	**2D**	**3S**	**3P**	**3M**	**3D**	**4S**	**4P**	**4M**	**4D**	**5S**	**5P**	**5M**	**5D**	**6**
Seral Stage	**Early Seral**					**Early Seral**				**Mid-seral**				**Mid to Late Seral**				*****
Lodgepole pine							3				9							
Mixed conifer		111			4	445	293	428	27	228	2898	8109	3028	9	267	1092		74
Ponderosa pine		29	41	9	1		176	100	57	11	3							
Jeffery, Ponderosa, Sugar Pine											161							
Red fir	22	67	74	6		408	253	52	373	94	918	2006	960			209		19
White fir		123				599	244	13	14	159	969	2246	779		47	92		29
Total acres	**22**	**330**	**115**	**15**	**5**	**1452**	**969**	**593**	**471**	**492**	**4958**	**12361**	**4767**	**9**	**314**	**1393**		**122**

Source: Almanor District GIS (Vestra_veg)
S: sparse cover, 10-24 percent canopy cover
P: open cover, 25-39 percent canopy cover
M: moderate cover, 40-59 percent canopy cover
D: dense cover, 60-100 percent canopy cover
*Late Seral Stage

Environmental Consequences

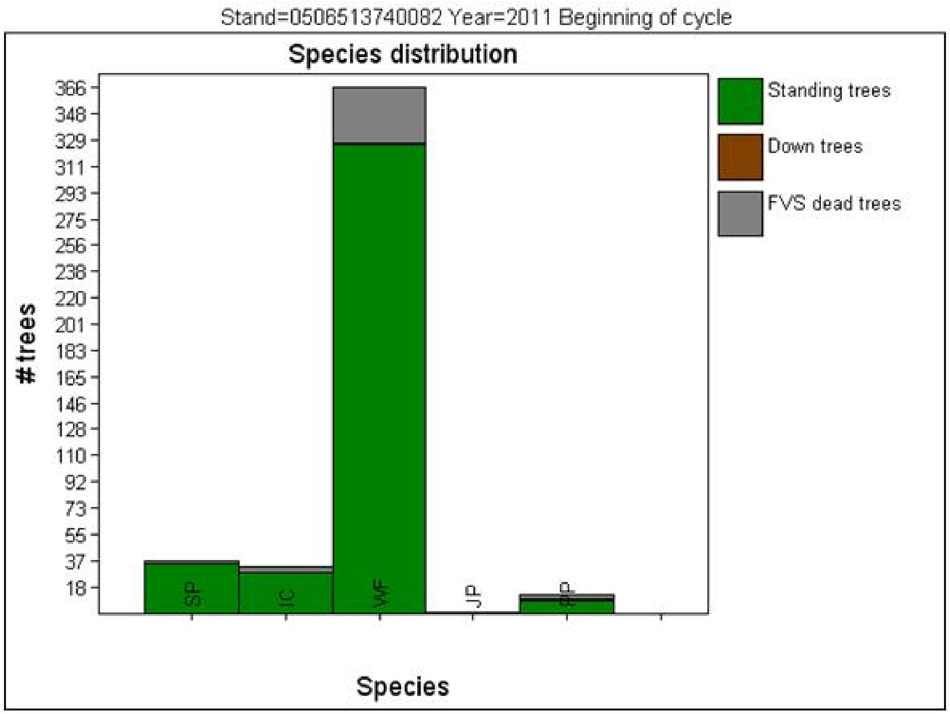
This section outlines the purpose and need indicators relevant to vegetation covered in the analysis and the effects each of the alternatives are expected to have on the indicators considered. Due to the complexity and length of the analysis contained in the silviculture report, for the sake of brevity this section summarizes the silviculture report prepared for this project. The silviculture report, located in the planning record, goes into more detail in terms of effects to tree species competition, stand density and structure, landscape age class distribution and economics and more fully describes the various methods used to analyze the effects.

Tree Species Composition Direct and Indirect Effects

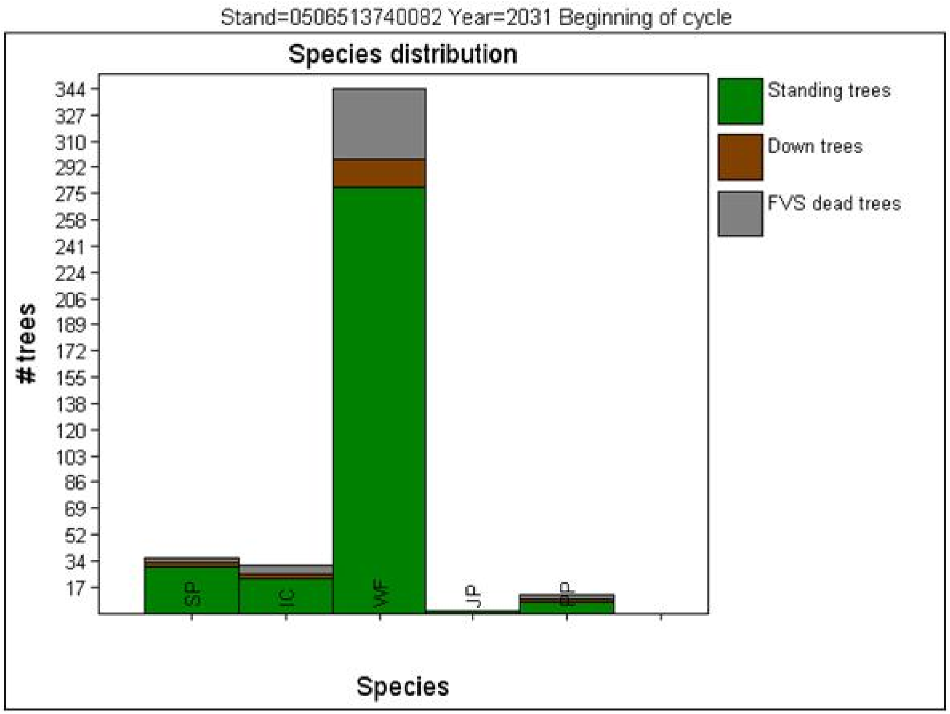
Alternative 1

Species composition would remain the same as described in the affected environment section throughout the project treatment areas. Existing stand structures would promote low light environments that influence species composition by favoring the regeneration of shade-tolerant species such as white and red fir, incense cedar, and to a lesser extent Douglas-fir. There would be no proposed disturbance or planting of shade intolerant, fire adapted species. The trend of having increased numbers of shade-tolerant species would continue. Thinning would not occur adjacent to large trees putting them at very high risk of density induced mortality and/or loss to wildfire.

A stand representative of the average stands in the project area was modeled to show species distribution at 2011 and 2031 using FVS (Figure 18).



M4M (CWHR 4M) stand at year 2011; no treatment



M4M (CWHR 4M)stand at year 2031; no treatment

Source: USDA Forest Service, “Forest Vegetation Simulator”

Figure 18. Representative mixed conifer stand species distribution at year 2011 and 2031 with no treatment

Pine

Pine would become increasingly susceptible to mortality as stand densities increase and stands would continue to shift to an increasing composition of shade tolerant species that are more adapted to persist at high densities. Stands that have been thinned within the last 30 years would grow at faster rates and be less susceptible to density related mortality; however, they would also have an increasing composition of shade tolerant trees as these species continue to establish and grow into the understory canopy. Pine regeneration would depend upon the creation of gaps by natural disturbance such as windthrow or pockets of bug kill that provide favorable light levels and seed bed conditions for the establishment and growth of pine seedlings. Existing pine plantations and overstory removal stands that have established and/or planted pine would continue to grow up into CWHR size class 3 and beyond, providing future pine overstory over approximately 3 percent of the project area.

Aspen

Aspen would continue to be overtopped and encroached by conifers. Regeneration would depend upon the creation of gaps by natural disturbance such as windthrow or pockets of bug kill that provide favorable light levels and seed bed conditions for the establishment of aspen suckering. Increased soil temperatures are needed to stimulate suckering and full sunlight is needed for good sucker growth.

Alternative 2

Pine

Approximately 7 percent (640 acres) of the available and suitable land base within the project area would be treated by group selection with the intent of creating conditions favorable for pine regeneration. Groups of trees from ½ to 2 acres in size would retain up to 60 square feet of basal area per acre of healthy pine if present but would generally remove all trees less than 30 inches in diameter creating very open stand conditions with approximate canopy cover between 0-15 percent. Groups would be designed to minimize the inclusion of trees 30 inches and larger however trees 30 inches and greater would be a component of groups. Groups would contain no more than up to twelve residual trees per acre.

Group selection harvest places groups in approximately 10 percent to up to 20 percent of stand area. The intent of the harvest method is to create a fully regulated uneven aged stand by rotation age. This is achieved by harvesting a percentage of the stand on a regular cutting until rotation age. At rotation age the stand would be uneven aged and harvest would be of original planted and/or naturally established groups. Based on a projected 20 year entry and a 175 year rotation age (HFQLG FEIS 1999), group harvest level would equate to 0.35 percent of the available and suitable land base per year, and at rotation age of 175 years only 61 percent of the available and suitable land base would be in group selection and regulated.

Table 33. Group selection treatments: existing forest cover, CWHR class, and post treatment CWHR class within treated stands

Forest Cover Type	Pre Treatment CWHR Class	Post Treatment CWHR Class	Acres
Mixed conifer	3M	1X	19
	3P	1X	2
	4D	1X	24
	4M	1X	278
	4P	1X	101
	5P	1X	2
Red fir	3D	1X	5
	3P	1X	12
	4D	1X	13
	4M	1X	66
	4P	1X	6
White fir	3M	1X	3
	4D	1X	13
	4M	1X	72
	4P	1X	22
	2S	1X	2
Total			**640**

Source: Almanor Ranger District GIS (Vestra_veg; Creeks FVS output files)
Note: No change to Aspen

Group selections would be prepared for reforestation. Site preparation would entail machine piling slash concentrations and burning piles. Subsoiling could be required to eliminate compaction resulting from use of groups or portion of groups as landings for harvest activities prior to planting on less than 640 acres and would be determined by a silviculturist/culturist and soil scientist. Subsoiling would occur within 5 years post harvest but prior to planting. Broadcast burning would occur in groups that are within DFPZ or area thin treatments that are broadcast burned.

Following harvest and fuel treatments, groups would create openings favorable in most cases for shade intolerant pine regeneration. Smaller group selections (less than 1 acre) and group selections within the red fir forest type would be more favorable for true fir regeneration (McDonald and Abbott 1994). McDonald and Abbott (1994) found that growth of ponderosa pine in 0.1 - 0.6 acre group selection units were poor (for example, many seedlings only 5 inches tall at 9 years of age), even though ponderosa pine seed cast and seedling germination was extremely high. Seedlings would come from natural, on-site seed sources and artificial planting. Planting by hand would occur on up to 640 acres and would supplement the natural regeneration to achieve desired stocking levels and increase the species composition of shade-intolerant species such as ponderosa, sugar, and Jeffery pine. The soil surface will be cleared of vegetation with a hand tool in a 1-2 foot diameter patch to prepare each site for tree planting. Reforestation is summarized in Table 34.

Table 33 displays the predominant forest cover, existing CWHR class, and post treatment CWHR class for the areas to be treated with group selection. Because the group selections are regeneration openings, they all classify as CWHR class 1 (seedling) post-treatment with an undetermined canopy (X).

Table 34. Group selection reforestation species mix and treatments by forest cover type

Forest Type	Group Size	Reforestation Treatments
Mixed conifer	All	Plant 60:20:20 mixture of PP/JP/SP a minimum of ½ tree length away from group edge for initial stocking density of 250 TPA. Adjust species mix site specifically to include DF where it naturally occurs. Approximately 426 acres
Red fir, White fir	All	Monitor post harvest for natural regeneration. Plant 20:20:60 mixture of RF/WF/JP-SP-WWP in Red fir zone, 20:10:70 WF/RF/JP-SP in White fir zone for initial stocking density of 250 TPA. Approximately 102 acres
All	All	Survey all groups for natural regeneration and planting survival at year 1, 3, and 5. Schedule interplanting where stocking levels are below R5 minimum levels or to promote pine regeneration.
All	1.0 acre or larger	Release for survival within 1 to 3 years of planting - monitoring would determine need and adjust treatment timing. Approximately 590 acres.
All	1.0 acre or larger	Mechanical release for growth within 3-5 years of planting – monitoring may adjust treatment timing. Approximately 590 acres.
Mixed conifer, Red Fir, White Fir	1.0 acre or larger	Monitor for gopher activity and schedule trapping as needed to reduce seedling mortality. Install browse protectors to prevent deer browse of terminal buds. Maintain for approximately 5 years. Approximately 300 acres combined.

Aspen

Aspen enhancement and associated foot print would occur on 299 acres. Removing competing conifers would improve plant species diversity and allow aspen to expand within the project area. Aspen reproduction is primarily by asexual means, i.e., root sprouts or suckers. Removing competing conifers to maximize sun exposure and reducing the insulating litter/surface fuel layer to stimulate potential for sprouting would create conditions conducive to restoring or expanding remnant aspen clones. Aspen is shade intolerant. Natural regeneration of aspen would be facilitated by the creation of openings around aspen to maximize sun exposure, soil heating, and reduce potential shading from adjacent conifers.

Aspen have shallow root systems that are susceptible to damage from ground disturbance and compaction. Mechanical harvesting, designated skid trails, and whole-tree or tree-length yarding (skidding) would reduce potential for compaction. Tracked mechanical harvesters with mounted booms can reach and fell many trees from a single location without moving. This reduces the amount of travel throughout the stand resulting in less potential for ground disturbance and/or compaction. Large trees that exceed the limitations of the harvester would be hand felled. Skid trails would be limited in the root zone of the aspen clone. Completing a single pass tractor rip of designated skid trails post harvest would reduce compaction and stimulate root suckering.

Aspen root systems are also susceptible to damage from concentrated burning (large hand piles or machine piles). Post harvest treatments would include hand piling and burning concentrations of existing down woody material up to 10 inches in diameter to reduce overall fuel loading. To reduce the potential for future conifer encroachment, young conifers smaller than 3.0 inches d.b.h. would be cut and hand piled. All hand piling for burning would occur outside the root zone of the aspen clone. Fuels reduction would also stimulate root suckering by removing the insulating litter layer to permit solar radiation to warm the mineral soil.

The existing microclimate at the site level (within proposed aspen units) would be altered in the short term. This could include increased soil moisture levels, increased solar radiation, increased soil and air temperature, and reduced relative humidity as a result of opening up the canopy. Many of these changes are desired and needed to facilitate successful regeneration of aspen. These changes would be limited in extent. As the new aspen stands become established, the canopy would begin to close, which would restore pre-treatment microclimate conditions. These aspen release units are designed to mimic natural disturbances (primarily fire).

Alternative 3

Pine

Group selection would occur on 660 acres of forested stands, for an increase of 20 acres of group selection as compared to alternative 2. Group selections, including site preparation and reforestation treatments would be the same as described under alternative 2. Planting would remain the same; however, 17 acres of newly established groups ¼ acre to ½ acre in size in treatment M would be monitored for natural regeneration prior to planting. A minimum of ten acres of these newly established groups would not be mechanically site prepped prior to planting. Release treatments would remain the same. Proposed gopher trapping and deer browse protection would remain the same.

Table 35. Alternative 3 group selection treatments: existing forest cover, CWHR class, and post treatment CWHR class within treated stands

Forest Cover Type	Pre Treatment CWHR Class	Post Treatment CWHR Class	Acres
Mixed conifer	3M	1X	15
	4D	1X	41
	4M	1X	274
	4P	1X	103
	5P	1X	2
Red fir	3D	1X	5
	3P	1X	8
	4D	1X	13
	4M	1X	74
	4P	1X	6
White fir	3M	1X	3
	4D	1X	14
	4M	1X	75
	4P	1X	25
	2S	1X	2
Total			**660**

Source: Almanor Ranger District GIS (Vestra veg; Creeks FVS output files)
Note: No change to Aspen

Extensive field review of groups as a result of collaboration led to groups in generally healthy mixed conifer stands with existing vertical and horizontal structure being dropped and added to adjacent thinning treatments to reduce density of mostly understory and midstory trees consisting primarily of white fir. In turn, groups were added to areas consisting of mostly white fir that had previously been thinned and generally lacking vertical and horizontal structure. Approximately 17 acres of groups designed to improve wildlife habitat were added in new treatment M areas. Additional groups added to treatment M are ¼ acre to ½ acre in size and are smaller than groups in alternative 2 (1/2 acre to 2 acres in size). Following harvest and fuel treatments, these groups would not be favorable in most cases for shade intolerant pine regeneration. Smaller group selections within the red fir forest type would be more favorable for true fir regeneration (McDonald and Abbott 1994). Due to small group size, growth of conifer regeneration would be reduced due to underground competition and shading from trees adjacent to the groups. Large retention trees within the groups would also reduce the growth of newly established conifers. Small groups would be oriented south and southwest as much as possible to minimize shade from adjacent trees. Response of ground vegetation is expected within the small groups (less than ½ acre) as they are located within and adjacent to openings with existing vegetation allowing available seed within the soil. Small groups within treatment M would be monitored for seedling establishment prior to planting as natural true fir regeneration would be anticipated.

Table 35 displays the acreage of predominant forest cover, existing CWHR class, and post treatment CWHR size class for the areas to be treated with group selection.

Aspen

Treatments proposed and effects are the same as those described under alternative 2.

Alternative 4

Pine

As compared to alternative 2 and 3, there would be no groups located within proposed treatment areas, including previously thinned stands, to improve existing and future structural and age class diversity, and other resource objectives such as pine and aspen regeneration.

Aspen

No aspen treatment is proposed. The effects would be similar to those described under alternative 1.

Cumulative Effects

The proposed thinning only from below without group selection would substantially reduce and/or eliminate vertical and horizontal stand structure. Areas having high densities of mid and overstory trees that exceed upper harvest diameter limits would restrict mechanical thinning and surface fuel treatment due to tree spacing. These areas would be similar to untreated leave islands and would remain overstocked having effects similar to those described under the no-action alternative. The size and location of untreated areas would be based on stand conditions and may not meet DFPZ canopy and surface fuel, and design objectives.

Stand Density and Structure Direct and Indirect Effects

Alternative 1

Approximately 43 percent or 12,347 acres of the project area forest stands are at or above 60 percent of maximum stand density index (SDI). With no treatment or major disturbance, an additional 2,486 acres or approximately 9 percent of forested stands would reach or exceed 60 percent of maximum stand density index within 10 years. Over 50 percent of the project area would be in a densely stocked condition. With little or no disturbance, growth rates in stands near or above 60 percent of maximum stand density index would continue to decrease. The average stand diameter would change little in these stands without disturbance.

Under alternative 1 average stand conditions were modeled using the Forest Vegetation Simulator (FVS) to show a representative stand at year 2011 and projected to year 2031. Growth projections are based on the FVS model and adjusted by measured growth rates of similar stands within the project area. Projections are included in the silviculture report located in the planning record.

CWHR

CWHR density “M” stands would slowly shift into canopy density “D” but only where site resources could support these densities. Eventually density induced mortality would create heavy fuel loading making surviving trees more susceptible to total loss from wildfire. If mortality is delayed until stand density index reaches ninety to one hundred percent of maximum stand density index stands could become stagnant and lose any potential to develop further. The more open stands, CWHR canopy density “P” (25 percent to 39 percent canopy closure) and “S” (10 percent to 24 percent canopy closure) would generally grow at faster rates as compared to stands of higher density due to less inter-tree competition. Their growth rates would be dictated more by factors of site quality rather than stand density. Natural disturbance could change the CWHR size class distribution. Pockets of mortality due to insects, disease, windfall, or wildfire could create CWHR size class 1 stands. Mortality of understory trees due to competition, insects, or disease, and growth of residual overstory trees would increase size class; however, selective bark beetle mortality of large diameter trees could cancel this affect and reduce the size class of stands. As stands reach and persist at maximum densities, they would remain at high risk of widespread mortality from insect and disease outbreaks. Mortality, particularly of understory trees, would increase hazardous fuel loading increasing the chance of total loss to wildfire.

Because average stand diameter growth is slow at higher densities, only a small portion of CWHR size class 4 stands would grow up into size class 5(trees greater than 24 inches). Most of these would be recruited from larger diameter CWHR 4P stands whose open structure is a result from previous thinning. The predominant change in CWHR size and density class distribution over the next two decades under no treatment would be an increase in CWHR 3M and 4M stands such that they would account for nearly half of the acres of forest cover type in the project area. Open canopied stands (less than 40 percent cover) of all size classes would account for approximately 20 percent of the acres of forest cover type in the project area.

Alternative 2

Effects to stand structure and stand density index (SDI) for all treatments under alternative 2 are summarized in Table 36. Further details of effects by treatment are located in the silviculture report located in the planning record.

DFPZ treatments

Within all DFPZ treatments, trees would be thinned throughout all size classes but emphasis would be to remove primarily smaller trees in the understory (thin from below) leaving the largest, healthiest, and generally the most fire resilient trees. To enhance structural diversity some healthy trees in the mid story and understory would be retained where they are growing well and isolated from serving as ladder fuels. Overstory trees would be irregularly spaced to provide for crown fuel separation. Healthy trees of shade intolerant species (pine species and Douglas-fir) would be favorably retained. However, trees of all occurring species would be retained to maintain species diversity. Residual average canopy cover would range between 30 percent and 50 percent.

In order to maintain habitat and conditions for wildlife species, stands located in the red fir belt as well as stands having a quadratic mean diameter of 24 inches or greater (categorized as CWHR 5M, 5D, and 6 size stands) with existing canopy cover of 40 percent or greater would retain stand structure considered to be at or beyond the upper end of the desired range for effective DFPZ treatment. These stands would retain a canopy cover of approximately 40 –50 percent, and, in addition, would retain untreated islands designed to increase diversity.

Table 36. Summary of alternative 2 treatment residual stands

Rx	acres treated	residual canopy cover %	average increase in stand diameter	residual BA[a]	residual SDI %	portion of stand targeted for removal
DFPZ-A	2995	40	7”	90-210	30-45	Remove an average of 30 percent of stand basal area. Most trees to be cut would be white fir in the understory. 12” and less.
DFPZ-B	94	40-50	6-7”	177-236	35-45	Remove an average between 5 – 10 percent of stand basal area targeting trees 20 inches d.b.h. and less.
DFPZ-C	178	40	4-5”	110-190	34-51	Remove an average of 5 percent of stand basal area targeting trees 8 inches d.b.h. and less.
DFPZ-O	683	40	4”	140-230	37-58	Remove between 12 percent – 30 percent of basal area targeting trees less than 24 inches d.b.h.. Most cut trees would be mid story and understory trees.
D	1406	30-40	5”	120-210	31-45	Remove an average between 20 – 29 percent of basal area targeting understory and smaller mid story trees t generally 12 inches d.b.h. or less.
E	1765	40-50	3-5”	140-230	37-54	Remove between 15 percent – 30 percent of basal area targeting mid story and understory trees.
GS	640	0-15	n/a	n/a	n/a	
RHCA	188	40-50	2-10	160-260	40-62	Remove an average between 2 – 17 percent of basal area stocking.
Total	**7949**					

a – BA or basal area refers to the cross section area of the trees in a stand, generally expressed as square units per unit area. Tree basal area is used to determine percent stocking.

Non-treatment leave islands within DFPZ and area thin treatments would retain dense pockets of untreated understory and overstory trees. Tree densities within untreated islands would remain high and susceptible to density induced mortality and would be a future source of additional snags. Thinning would occur around untreated leave islands reducing potential of the retention islands to serve as ladder and canopy fuels to adjacent overstory trees; however, ladder fuels would remain within retention islands and they would be at risk of total loss should a wildfire occur. Because these leave islands are relatively small and dispersed, residual stand structures would still be predominantly open and dominated by irregularly spaced overstory trees.

Mechanical treatment of surface fuels and/or prescribed burning would be conducted in DFPZ stands post-thinning to remove remaining surface fuels in excess of desired levels. Equipment used to mechanically treat surface fuels, like the equipment used during harvest operations, can damage residual trees particularly as residual stand density increases. The effects of mechanical damage, which are typical, would be minimized as thinning would generally provide 16 feet spacing between trees for equipment to operate, and both service and timber sale contracts provide measures by which stand damage can be minimized. Conifers and shrubs would benefit from prescribed fire as nutrient availability would increase. Prescribed burning poses a risk of damaging cambium and crown or killing residual trees and could cause subsequent bark beetle attack. This risk is mitigated by concentrating fuels away from live trees, and by burning under weather conditions that promote low flame lengths and low burning intensities. Generally, mortality from 0 percent to 10 percent of stand basal area may occur as a result of prescribed burning. Mortality from prescribed burning would primarily occur in smaller understory trees that have thinner bark and crowns closer to ground level. This prescribed burning would not appreciably alter post-thinned stand structure

Post harvest DFPZ treatments would include mechanical mastication of existing brush in plantations. Brush would not be treated in approximately 15 percent of the area within plantations for wildlife resources (see wildlife integrated design features in appendix A). Mastication would reduce ladder fuels and continuity between surface and ladder fuels within plantations. This treatment would reduce the potential for torching and crown fire initiation. However, over time ladder fuels would increase as shrubs would regenerate. Removal of small trees and brush would raise canopy base heights within plantations approximately 8-10 feet from existing and increase growth of residual trees. Increased surface fuel load from the mastication would increase the average length of time that burning would occur (resident heat). These conditions of an increased surface fuel load and longer burning times could lead to increased root damage, bole damage, crown scorch, and an overall higher likelihood of increased tree mortality.

Understory vegetation growth response to treatment would be highly variable with an increase primarily in group selection areas. Understory vegetation response would generally be best in DFPZ units where canopy cover would be reduced the most. Reduced canopy cover will allow more sunlight to the forest floor however the residual trees will continue to dominate site resources and tree roots will grow into newly available growing space. DFPZ maintenance is projected to occur between 5 to 30 years to treat understory vegetation growth and surface fuel accumulations, with most stands projected to need maintenance treatment at 10 years.

Area Thinning

Area thinnings would generally have a higher component of mid and understory trees than DFPZs, where healthy trees in these crown positions are pre-existing. Within all area thin treatments, healthy fire-resilient dominant and co-dominant overstory and healthy understory trees would be retained. Overstory trees would be irregularly spaced to provide for crown fuel separation. Healthy well-growing trees in the mid story and understory would be retained with an emphasis of breaking up ladder fuels. Healthy trees of shade intolerant species (pine species and Douglas-fir) would be favorably retained; however, trees of all occurring species would be retained to maintain species diversity. Residual average canopy cover would range between 40 percent and 50 percent dependent upon existing canopy cover, and untreated leave islands to increase diversity would be left in 15 percent or approximately 166 acres of the treatment area. Mechanical fuels treatment would be conducted in area thinned stands post-thinning to remove remaining surface fuels in excess of desired levels. Equipment used to mechanically treat surface fuels can damage residual trees particularly as residual stand density increases. Post harvest treatments would include mechanical mastication of existing brush in plantations. Brush would not be treated in approximately 15 percent of plantations for wildlife resources (see wildlife integrated design features in appendix A). Effects of plantation mastication within area thin treatment would be similar to the effects identified under DFPZ treatments.

Understory vegetation growth in area thin treatments is expected to be variable but generally slow, similar to that in DFPZs. Vegetation growth may be further suppressed in area thin units because of generally higher canopy cover and stand densities.

RHCA

RHCA inner treatment areas have open to moderate overstory densities with high densities of small, less than 12 inch trees. Stands are at high risk of loss to wildfire or density induced mortality. Treatment would remove primarily understory and smaller mid story trees that serve as ladder fuels. Most trees to be cut would be white fir in the understory, generally 12 inches d.b.h. or less; however, occasional larger trees up to 23.9 inches d.b.h. would be cut to reduce high tree densities.

Approximately 188 acres of inner RHCA zones would be treated. Within inner RHCAs, riparian management objectives would include removal of small understory and midstory trees that contribute to high stand densities and serve as both ladder and canopy fuels. A minimum of 40 percent canopy cover and higher would be retained where available. Approximately 38 percent of the stands would maintain a minimum of 50 percent canopy cover. Trees within all size classes would be retained to maintain and improve structural diversity within RHCAs. The healthiest understory trees would be retained wherever possible. The healthiest midstory trees would be retained; however, some relatively unhealthy midstory trees would also be retained to maintain canopy cover. All trees 24 inches would be retained regardless of health or existing density.

Most tree decadence occurs within the largest trees. Existing large tree decadence would be maintained within RHCAs. Some relatively small areas with low to moderate trees densities would not be treated. Existing stand densities generally range 43 percent to 86 percent of maximum stand density index. Post treatment stand densities would generally range between 40 percent and 62 percent of maximum stand density index. Post treatment stand densities would generally not allow trees to be completely free to grow and would be at densities where some density induced mortality could occur. The number of trees per acre retained within RHCAs would generally be higher than within area thin treatments and would generally have a higher component of mid and understory trees. Healthy trees of shade intolerant species (pine species and Douglas-fir) would be favorably retained; however, trees of all occurring species would be retained to maintain species diversity. Treatment would be conducted either by hand or mechanical equipment or a combination of the two methods. Hand treatment would pile boles and limbs of trees primarily 6 inches d.b.h. or less, up to a maximum of 12 inches d.b.h., outside riparian vegetation areas for burning.

Table 37. Aspen treatments: existing and post treatment forest cover type, and CWHR cover and size class within treated stands for alternative 2

Forest Cover	CWHR class	Pre Treatment Acres	Post Treatment Acres
Mixed Conifer	4S	21	0
Ponderosa Pine	3S	3	0
Montane Riparian	CX	31	31
	2M	6	0
	2D	8	0
	3P	4	0
	3M	54	0
	4S	23	19
	4P	6	0
	4M	44	0
White Fir	4S	43	0
	5P	10	0
	5S	47	0
Aspen	2M	0	6
	2D	0	8
	3P	0	89
	3M	0	54
	4S	0	43
	4P	0	6
	4M	0	44
Total		**300**	**300**

Source: Almanor Ranger District GIS (Vestra_veg; Creeks FVS output files)

Roads, landings and openings

Harvest operations would have effects on forest stand structure. Tractor logging would require small clearings, or landings, generally less than 1/2 acre, to store logs prior to trucking. Landing size depends on the topography, the number of trees to be brought in. These clearings are expected to reforest with conifers based on field review of past landings within the project area.

Road construction, reconstruction and maintenance would clear trees from the road travel way and ditches. Most trees to be removed are saplings and seedlings, which have become established since construction or the last road maintenance treatment. The construction of 1.91 new miles and 3.57 miles of temporary road would clear approximately 17 acres of trees of all sizes. Temporary roads would clear approximately 11 acres of the approximate 17 acre total and would be obliterated at project completion. The approximate 11 acres affected by temporary roads would be expected to reforest based on field review of old roads within the project area. Road decommissioning is planned for 11.09 miles of road. These roads are adjacent to forested stands and would result in the reforestation of approximately 34 acres. Treatments preclude the harvest of trees 30 inches in diameter and larger; however, in some cases, these trees may need to be cut to facilitate operability (SNFPA ROD 2004). These cases could include: clearing for landings, road construction, and danger tree removal. Danger trees would be felled and left on site as large down woody material. Clearing for harvest and road construction operations is expected to impact less than 1 percent of the treated areas.

CWHR

DFPZ: Changes in stand structure and density as a result of DFPZ treatments would occur. Most notable would be the decrease of acres of CWHR 4M among the forest cover types and subsequent increases in acres of CWHR 4P. The changes reflect a decrease of canopy densities, particularly in CWHR density class M and D stands, and increases in stand average diameter causing some stands to increase in CWHR size class and all stands to increase average stand diameter as a result of thinning from below. Changes in CWHR size and density class as a result of treatments can be found in the wildlife report located in the planning record. Forest inventory data throughout the project area was compiled to illustrate tree size class distribution within typical mixed conifer and true fir stands that would be thinned under DFPZ treatment A. Projections of diameter and species distribution are depicted in the silviculturist report in the planning record.

Area Thinning and Group Selection: Treatments D and E are area thinning with the difference being E includes stands that currently provide suitable California spotted owl and American marten habitat consisting of CWHR size and density class 4M, 4D, 5M, 5D, and 6. Thinning and group selection would change the distribution of CWHR size classes. There would be an increase in the seedling size class stands and medium/large size class stands, and a corresponding decrease in the pole and small sawtimber size class stands. Stand densities would decrease as a result of treatments. A summary of the distribution of all CWHR classes in the project area showing acres of change resulting from alternative 2 can be found in the wildlife report located in the planning record.

The most notable change in stand structure resulting from thinning is the decrease of CWHR density class D. The changes in acres of CWHR class reflect a decrease of canopy densities in CWHR M and D stands, and increases in stand average diameter causing some stands to increase in CWHR size class as a result of thinning from below. Changes in CWHR size and density classes as a result of treatments can be found in the wildlife report located in the planning record. Because of canopy cover retention requirements within area thinning units, no stands that are CWHR density class M or D pre-treatment would fall below density class M after thinning.

Alternative 3

DFPZ

Alternative 3 would apply the same DFPZ treatments as described under alternative 2 with the exception of a change to treatment A on 910 acres that are identified for new treatment M. Treatment M would treat surface, ladder, and canopy fuels in CWHR 4M, 4D, and size 5 stands. Under treatment M, non treated “leave islands” would be retained over 15 percent of the treatment stands. Non treatment areas would focus on leaving areas with dense pockets of medium to large size trees in midstory and overstory canopy levels. Thinning would occur around the leave islands to prevent them serving as ladder fuels to adjacent overstory trees. Non-treated “leave islands” would retain an additional component of understory trees in the DFPZ units to provide additional cover and stand heterogeneity for furbearer habitat. The non-treatment leave islands would not have desirable fuel configurations and would be susceptible to torching during a wildfire. Under treatment M, canopy cover would be retained between a minimum of 40 percent, where available, and 50 percent. Generally, stands with existing canopy cover at or above approximately 58 percent would be retained at 50 percent. Treatment M would favor retention of healthy trees in the upper canopy layers but would retain more unhealthy trees as compared to the proposed action to maintain higher canopy cover. Higher canopy cover equates to higher canopy fuels and reduced tree growth when compared to proposed action treatment. Table 38 lists treatment acres and the differences between treatments A and M.

Table 38. Comparison of treatments A and M

	Treatment A	Treatment M (change from A)
Treatment acres	2995	910
Thinning Treatment	Surface and ladder fuels, generally up to 12 inches d.b.h.	same
Residual canopy cover	Generally <40%	Retain 40% where preexisting to 50%
Basal area removed	20% -30%	10% – 25% w/ very few stands 30%-35%
Non-treatment areas	none	15% (approximately 151 acres)

As under alternative 2 mechanical treatments of surface fuels and prescribed burning would be conducted in DFPZ stands post-thinning to remove surface fuels in excess of desired levels. The risk of mortality from prescribed burning would be higher in non-treated leave islands however overall prescribed fire mortality levels would still be low, generally from 0 percent - 10 percent of stand basal area. Prescribed burning would not appreciably alter post-thinned stand structure.

In DFPZ treatment areas, there would be approximately a 23 acre increase of post thinning mechanical mastication of brush within plantations as compared to the proposed action. Effects would be the same as identified under the proposed action.

Understory vegetation growth would be similar as described under alternative 2. Vegetation growth would be suppressed within dense leave islands and density induced mortality would be a source of future snag recruitment. Projected DFPZ maintenance treatments and their timing would be the same as alternative 2. Canopy cover retention is within the range analyzed under the proposed action and the non-treatment leave islands would not alter projected post-treatment vegetation types.

Area Thinning

The prescribed treatments for area thinnings would be the same as alternative 2. Some areas identified under alternative 2 for area thinning were dropped because they were located in areas that have recently been thinned and have little need for thinning. In addition, some areas proposed for area thinning in alternative 2 increased in acreage primarily as a result of groups that were dropped and the areas that were added to the adjacent thinning treatment. Changes in treatment areas and treatments were the result of extensive field review. The result of the review led to alternative 3 having a net increase of 111 acres to treatment D and a net reduction of 43 acres to treatment E.

Understory vegetation growth would be as described under the proposed action with the exception that vegetation growth would be slower in unthinned leave islands.

CWHR

DFPZ: Direct effects on the distribution of CWHR classes would be marginally different from alternative 2 with the exception being an additional 130 acres of CWHR 5M, 113 acres less of CWHR 4M, 120 acres less of CWHR 4P, 84 additional acres of CWHR 4S, and an additional 20 acres of CWHR size 1. Similar to alternative 2, most notable is the increase of approximately 897 acres CWHR size and density class 5P and 5M stands, a decrease of approximately 2,319 acres of CWHR size and density class 4M and 4D, and a 660 acre increase in seedling size stands. In addition, the decrease in CWHR size and density 4M and 4D correspond to the increase in CWHR size class 4S and 4P stands. Both higher canopy retention and average stand diameter resulting from less thinning within the midstory and overstory canopy levels would decrease CWHR 4P strata by 120 acres and increase CWHR 5M strata by 130 acres over alternative 2. A more detailed breakdown of changes in CWHR size class can be found in the wildlife report located in the planning record. The trends and causes of general canopy decrease and size class increase are the same as analyzed under alternative 2.

Area thinning: Area thin treatments would maintain average canopy cover at or above 40 percent in CWHR 4M, 4D, and 5M stands. Canopy cover retention would apply to CWHR 5D and 6 stands as well. Thinning would be conducted outside of the non-treatment leave islands as described under the proposed action and basal area removed would fall within the range analyzed in the proposed action. The risk of mortality from prescribed burning would be higher in non-treated leave islands however prescribed fire mortality levels would still be low, generally from 0 percent - 10 percent of stand basal area. Mortality risk in leave islands would be minimized by controlled ignitions within the leave islands. Prescribed burning would not appreciably alter post-thinned stand structure.

RHCA: Effects to stand density and structure would be the same as described under alternative 2.

Roads, landings and openings: The effects of roads and landings would be essentially the same as those described under alternative 2.

Alternative 4

Thinning only from below to meet fuels objectives would substantially reduce and/or eliminate existing vertical and horizontal structure. Areas having high densities of mid and overstory trees that exceed upper harvest diameter limits would remain overstocked and would have effects similar to those described under the no-action alternative (alternative 1) for overstocked stands.

Leave islands consisting generally of dense pockets of understory and overstory trees within DFPZ and area thin treatments would not be retained. Stand densities would generally not be reduced enough to promote the health and regeneration of pine. Generally stands with pockets of trees exceeding upper treatment diameters would either be at undesirable densities or would be expected to grow to undesirable maximum densities approximately ten years sooner than similar stands treated under alternatives 2 and 3. However, some thinned stands are expected to remain below undesirable maximum densities for approximately 15 to 20 years. A minimum of approximately 30 percent canopy cover would be retained where available. Small understory trees serving as ladder fuels would be treated in stands with less than 30 percent canopy cover and surface fuels would also be treated.

Table 39. Summary of alternative 4 treatment residual stands

Rx	Acres Treated	Residual Canopy Cover	Average Increase in Stand Diameter	Residual BA	Residual SDI	Portion of stand targeted for removal
DFPZ 1	1735	30	11-13	140-325	30-63	Remove trees 14 inches d.b.h. and less. With the exception of younger stands such as plantations, overstory stand structure would not be appreciably altered by this treatment. Remove an average ranging between 8 percent and 15 percent of stand basal area.
DFPZ 2	816	30-40	9-13	150-180	35-50	Remove an average between 12 - 30 percent of stand basal area. Remove trees 12 inches d.b.h. and less.
DFPZ 3	952	23-40	10-16	140-200	34-61	Remove an average of 8 percent of stand basal area stocking. Remove trees 14 inches d.b.h. and less.
Area Thin 4	2793	30-40	2-10	130-244	37-59	Remove an average between 8 – 13 percent of stand basal area in small stands and up to 34 percent of stand basal area stocking in small size stands. Remove trees 14 inches d.b.h. and less.
Area Thin 5	183	30-40	10	148	23-41	Remove an average of 31 percent of stand basal area within RHCA areas. Most cut trees would be mid and understory trees less than 12 inches.

DFPZ Treatments

As compared to the alternative 2 and 3, there would be 447 and 711 acres less DFPZ, and 378 and 310 acres less of area thinning respectively. Areas proposed in alternatives 2 and 3 that have been previously thinned meet fuels objectives for alternative 4 and were not proposed. Leave islands would not be placed within treatment areas.

Within all DFPZ treatments, the smallest trees in the understory would be removed (thin from below) to reduce ladder and canopy fuels leaving the larger and generally the most fire resilient trees. Areas overstocked with trees larger than maximum harvest diameters would be left and would consist of trees in all crown positions. Crown fuel separation would be variable as it would be limited to the removal of trees equal to or less than the upper harvest diameter. Unhealthy trees larger than the upper harvest diameter would be retained. Trees of more shade intolerant species (pine species and Douglas-fir) would be favorably retained as they are generally more fire resilient than true fir species. A minimum residual average canopy cover of 30 percent would be maintained where available and would range up to approximately 40 percent. Residual overstory and midstory stand structures would remain as existing. Small understory trees serving as ladder fuels would be removed and as a result understory structural diversity would be virtually eliminated in areas with moderate to dense overstories with medium to large size trees. Canopy cover within these areas would be reduced by approximately 10 percent of existing.

Stands or openings within stands having mostly small trees meeting treatment for removal would maintain a minimum of 30 percent canopy cover to meet stocking requirements. Untreated retention islands that could serve as ladder fuels would not be maintained further reducing diversity within stands.

Mechanical treatment of surface fuels and/or prescribed burning would be conducted in DFPZ stands post-thinning to remove existing surface fuels in excess of desired levels. Equipment used to mechanically treat surface fuels, like the equipment used during harvest operations, can damage residual trees particularly as residual stand density increases. The effects of mechanical damage, which are typical, would be minimized due to measures in timber sale contracts requiring practices to minimize damage. However, pockets with high densities of trees 16 inches d.b.h. and larger would either eliminate the ability of mechanical equipment to operate and/or increase risk of stand damage. Prescribed burning poses a risk of damaging or killing residual trees particularly if equipment used to treat surface fuels is unable to operate in areas with high densities of trees over 16 inches d.b.h.. Risk is mitigated by concentrating fuels away from live trees, and by burning under weather conditions that promote low flame lengths and low burning intensities. Generally, mortality from 0 percent to 10 percent of stand basal area may occur as a result of prescribed burning. Mortality is expected to be higher in the dense pockets where mechanical treatment and piling is not able to occur. Within DFPZ treatments, mastication would reduce ladder fuels and continuity between surface and ladder fuels within plantations. This treatment would reduce the potential for torching and crown fire initiation. However, over time ladder fuels would increase as shrubs would regenerate. Areas with high densities of trees 16 inches d.b.h. and larger would either eliminate the ability of mechanical equipment to operate and/or increase risk of stand damage.

Understory vegetation growth response to treatment would be highly variable but would generally be best in DFPZ units where canopy cover would be reduced the most. Reduced canopy cover will allow more sunlight to the forest floor however the residual trees will continue to dominate site resources and tree roots will grow into newly available growing space. DFPZ maintenance is projected to occur between 5 to 10 years to treat surface fuel accumulations.

Area Thinning

Area thin treatments are designed to break up fuel continuity by reducing surface, ladder, and canopy fuels. Thinning would consist of the removal of the smallest trees in the understory, thinning from below. Small, medium, and large size overstory and midstory trees would be left as existing and areas overstocked with trees larger than 14 inches d.b.h. would be left as existing. Crown fuel separation would be limited to the removal of only trees 14 inches d.b.h. or less and would be variable. All trees, including unhealthy trees, larger than 14 inches d.b.h. would be retained. A minimum residual average canopy cover of 40 percent would be maintained where available and would range to over 60 percent. Small understory trees serving as ladder fuels would be removed and as a result understory structural diversity would be virtually eliminated in areas with moderate to dense overstories with medium to large size trees. Canopy cover within these areas would be reduced only by approximately 10 percent of existing. Stands or openings within stands having mostly small trees meeting treatment for removal would maintain a minimum of 30 percent canopy cover to meet stocking requirements. Untreated retention islands that could serve as ladder fuels would not be maintained further reducing diversity within stands.

Mechanical treatment of surface fuels and/or prescribed burning would be conducted post-thinning to remove existing surface fuels in excess of desired levels. Pockets with high densities of trees larger than prescription limits would either eliminate the ability of mechanical equipment to operate and/or increase risk of stand damage. Prescribed burning poses a risk of damaging or killing residual trees particularly if equipment used to treat surface fuels is unable to operate in areas with high densities of trees larger than prescription limits. Mortality from prescribed burning would generally be higher than DFPZ treatment as stands have more areas with high densities of trees 12 inches d.b.h. and larger that would be retained limiting access and treatment. Mortality of large overstory trees would increase within areas where surface and ladder fuel loading could not be reduced with mechanical equipment.

Within existing plantations, post harvest treatments would include mechanical mastication of existing brush on approximately 400 acres. Effects of plantation mastication within area thin treatment would be similar to the effects identified under DFPZ treatments.

RHCA

Structural diversity within RHCA treatment areas would be reduced due to the elimination of understory trees in areas having moderate to high densities of overstory trees to meet fuels objectives. Moderate to high densities of trees in mid and overstory canopy exceeding upper harvest diameter would remain. RHCA treatment areas with high densities of trees exceeding harvest diameter limits would be at 60 percent of maximum stand density index, the zone of imminent mortality, either immediately post treatment or within 10 - 15 years and would have more snags and decadence contributing to fuel loading than stands treated under alternative 2 and 3. Post treatment, ladder fuels that could contribute to high fire intensities would be reduced as well as stand density which would improve overall stand health and fire resiliency. Reducing high densities in areas with predominantly less than 6 inches d.b.h. trees and retaining the healthiest of the small trees would improve existing and future tree size, structural diversity, and help to improve and maintain stand health for approximately 20 years as compared to no treatment.

Roads, landings and openings

Effects of alternative 4 harvest operations would be the same as alternatives 2 and 3 except for areas having high densities of trees larger than the upper harvest diameter limit. Mechanical equipment used for both harvesting and fuels treatments would not be able to operate in areas with high tree densities having an average distance between trees less than approximately 16 feet. These high density areas would also have a high potential for mechanical tree damage.

Road construction, reconstruction and maintenance would have the same effects as those described in alternatives 2 and 3 with the following changes in miles and forested acres affected. Alternative 4 would construct 1.21 miles of temporary road that would clear approximately 3.7 acres of trees of all sizes which is 7.3 acres less than alternatives 2 and 3. The approximate 3.7 acres affected by temporary roads would be expected to reforest. Alternative 4 would not decommission additional roads beyond the 1.21 miles of temporary road constructed to implement the project. Since new road construction would be the same as proposed under alternative 2 and 3, and additional road decommissioning would not occur, approximately 5.8 acres of forested lands would be cleared and removed from the project area. Clearing for harvest and road construction operations would impact less than 1 percent of the project area.

CWHR

Due to upper harvest diameter limits and thinning strictly from below, alternative 4 generally maintains more overstory canopy resulting in less change to CWHR density when compared to the other proposed action alternatives.

DFPZ: Stands proposed for DFPZ treatment that are CWHR density class D would drop to a lower density class after treatment only if average diameter ranges are below upper harvest diameter limit. Stands with average diameters that exceed the upper harvest diameter limit would have reduced canopy cover but generally not enough to change CWHR classification to a lower density.

Because of the initial high densities of CWHR “D” stands, and the design of DFPZ treatments, canopy cover is not projected to fall below 40 percent in those stands. Stands with initially lower densities (CWHR density class M stands that are near or below 50 percent canopy cover pre-treatment) are projected to drop to CWHR density class P following a DFPZ treatment if there is a high component of trees meeting harvest diameter that could be removed.

Area Thinning: Similar to alternative 2 and 3, thinning would change the distribution of CWHR size classes. Stand densities would decrease as a result of treatments. A more detailed breakdown of changes in CWHR size class can be found in the wildlife report located in the planning record. Most notable is the decrease of CWHR 4M and 4D density classes and a corresponding increases in CWHR 4P, 5M. Because each CWHR class represents a range of average stand diameter and canopy cover, the effects of treatments on the CWHR classification will vary by stand.

Because of canopy cover retention requirements within area thinning units, no stands that are CWHR density class M or D pre-treatment would fall below density class M after thinning.

Cumulative Effects

Descriptions of current stand composition, structure and density account for and include changes as a result of past actions, such as timber harvest, described in the list of cumulative actions (appendix C). Previous timber harvest from the mid-1970s to the present occurred on approximately 18,140 acres. Intermediate thinnings occurred on 8,110 acres and include intermediate sanitation, prep step shelterwood, and thinning. Intermediate sanitation focuses on removing trees that are damaged, diseased, have small live crowns or otherwise exhibit low vigor and growth rate. Prep step shelterwood is a heavy thinning from below to promote the vigor and crown development of future seed bearing trees and is an intermediate thinning prior to a seed step cut (discussed below). Thinning from below removes predominantly smaller trees and retains healthy larger overstory trees. Thinning from above removes decadent or poorly growing overstory trees to release healthy smaller trees from the midstory and understory; healthy overstory trees are retained as well. Regenerative cuttings occurred on 2,230 acres and include clear cuts and seed step shelterwoods. Clear cuts remove all or virtually all trees and the stand is regenerated by planting. Plantations resulting from these clearcuts are currently typed as CWHR size 2 and 3 stands and represent less than 3 percent (877 acres) of the forest cover in the project area (not including private land). Seed step shelterwoods retain ten to fifteen overstory seed trees per acre to provide seed fall for natural regeneration. Shelterwoods occur in true fir stands and most of the stands still retain the overstory seed trees. Without additional cutting, these stands will continue to develop as two-storied true fir stands with dense regeneration growing in from successive seed crops. Overstory removal occurred on 5,534 acres and entailed removing all or virtually all of a stands overstory while retaining healthy intermediate and understory trees. Where healthy pine were retained or subsequently interplanted, these overstory removal treatments are projected to develop mixed conifer overstories over the next several decades. Salvage harvesting of fire killed or wind thrown trees has occurred on approximately 2,266 acres. While nearly half of the project area has experienced some level of timber harvest in the last 30 years, stand growth data from within the project area suggests that previous harvest and natural mortality has not kept pace with overall forest growth. The current preponderance of CWHR 4M and 4D stands is mostly a result of ingrowth and increasing density of stands that have been partially cut in the past. With the exception of clearcutting and overstory removal, previous thinnings promote the regeneration of predominantly shade tolerant white fir.

Activities such as Christmas tree cutting, cutting of posts and poles, and firewood have and will continue to have little effect on stand structures except within small localized settings. Christmas tree cutting generally selects for healthy open grown fir seedlings that may otherwise grow into mid or overstory trees, however cutting is concentrated in a narrow band along a few accessible roadways. While firewood cutting occurs throughout much of the project area, the level of removal of dead wood has no appreciable effect on stand growth or understory regeneration. Ground disturbance from vehicles accessing firewood can injure small trees as well as expose mineral soil as a seed bed for new seedlings, however live overstory trees still provide the most dominant influence on understory development.

DFPZ and area thinning would occur within areas of previous harvest activity. In stands that have had previous intermediate thinning, proposed treatments would focus on breaking up undesirable dense pockets of trees and removing ladder fuels growing underneath healthy overstory. Some mid and upper story trees would be removed in stands that were previously lightly thinned (such as intermediate sanitation) to reduce undesirable stand densities and crown fuels. Proposed DFPZ and area thin treatments in regeneration cuts or overstory removals would focus on treating surface fuels including brush and thinning young trees to remove ladder fuels and provide crown separation. Stands that have had salvage harvest of fire killed or windthrown trees can contain a wide range of residual stand structure. DFPZ and area thin treatments in these areas would primarily focus on protecting healthy residual overstory and understory trees by removing ladder fuels and surface fuel accumulations; mid and upper story trees would be thinned in undesirable dense pockets. Non-treatment leave islands within DFPZ and area thin treatments would retain dense pockets of understory and overstory trees. Because these leave islands are relatively small and dispersed, residual stand structures would still be predominantly open and dominated by irregularly spaced overstory trees.

Under alternative 3 DFPZ and area thin treatments would reduce stand densities and promote the health of pine. This “release” affect of decreased competition would be shorter lived in DFPZ treatment M stands because higher initial densities would be retained. These stands are expected to grow to undesirable maximum densities approximately ten years sooner than similar stands under DFPZ treatment A. However, all thinned stands are still expected to remain below undesirable maximum densities for approximately 15 to 20 years. Young stands or stands that are initially sparse (CWHR canopy class S and P) may remain within desired densities for three decades or more. Projected DFPZ maintenance treatments and their timing would be the same as under the proposed action. Canopy cover retention is within the range analyzed under the proposed action.

Group selections would increase stand structure diversity and provide regeneration to replace decadent overstory trees as they die out, both within thinned and unthinned stands.

Maintenance treatments such as hand and mechanical (i.e. mastication within planted areas) removal of small trees, brush, down fuels, and underburning are planned within DFPZ, area thinning, group selection, and aspen release. The majority of these treatments would occur within approximately 10 years and would remove small trees and brush through hand treatment, mechanical treatment, or underburning. The planned maintenance treatments would maintain open understories in combination with areas of small trees, shrubs, and untreated areas to create a diverse vertical and horizontal forest structure.

Road construction from past projects throughout the project area has decreased the forested area. Existing roads consist of approximately 330 acres of formerly forested lands that are now within road right-of-ways. Road construction and decommissioning under alternatives 2 and 3 would result in an overall decrease of land in road right-of-way. New proposed road construction (1.91 miles) would clear approximately 6 acres of land, and proposed temporary roads (3.57 miles) would clear 11 acres of land but would be decommissioned after use and eventually would regenerate with conifers and other forest vegetation. There would be a net increase of 6 acres of cleared land as a result of road work associated with proposed vegetation treatments. However, an additional 11.09 miles of road decommissioning are proposed in the Creeks II project area which would equate to approximately 34 acres of decommissioning resulting in an overall decrease of 28 acres of land affected by roads in the proposed project area.

Prior to 2002, thinnings were the predominant timber harvest method on private forest lands within the project area at a rate of approximately 10 percent of private forest lands per decade. Changes in private ownership have caused changes in private forest management within the project area. Currently, approximately 1,721 acres or roughly 60 percent of private land holdings within the project area are being harvested, predominantly as thinning, overstory removal and clear cuts. For cumulative effects analysis, overstory removal or intermediate thinning (partial cutting) is projected to occur over the remaining private commercial timber lands in the project area within the next four decades. In total, overstory removal harvests are projected to occur over 80 percent of private commercial timber lands and intermediate thinning harvests over the remaining 20 percent. This estimate does not account for any non-treatment areas such as streamside management zones. Overstory removal harvests would leave low levels of stand density, composed predominantly of thrifty young trees generally between 6 and 12 inches d.b.h. This corresponds with CWHR classes 3S. Intermediate thinnings would retain moderate stand densities composed predominantly of thrifty young mature trees generally between and 30 inches d.b.h.. This corresponds with CWHR classes 4P and 4M.

Landscape Age Class Distribution Direct and Indirect Effects

Alternative 1

Relative age class distribution within the project area would remain unchanged. Conifer stands that are currently overstocked would remain so for an indefinite period of time or until wildfire and/or insects or other disturbance eventually creates openings by which new age classes could become established. There would also be a high risk of total loss to the above mention disturbances as overstocked conditions persist jeopardizing existing age class distribution in potentially very large areas. There would be an increase of large and small surface fuels as mortality and self pruning increased due to overstocked conditions further increasing risk of total loss. The potential loss of large areas of existing age classes would create more early seral stage on the landscape within the project area but the juxtaposition of age classes could increase substantially. Within overstocked areas overall growth would be reduced which would in turn reduce diameter growth lengthening the amount of time it would take for trees to become large increasing CWHR size class. Within overstocked areas CWHR density class would lower as tree mortality occurs but fuel loading associated with mortality would also increase. Shade intolerant species would continue to decline until disturbance occurs.

Alternative 2

Thinning and group selection would change the distribution of CWHR size classes. There would be a 640 acre increase in the seedling size class stands and a 782 acre increase in the medium/large size class stands, and a 2,220 decrease in pole and small sawtimber size class stands. Stand densities would decrease as a result of treatments. A more detailed breakdown of changes in CWHR size class can be found in the wildlife report located in the planning record.

Alternative 3

Similar to alternative 2 thinning and group selection would change the distribution of CWHR size classes. There would be a 660 acre increase in the seedling size class stands and a 910 acre increase in the medium/large size class stands, and a 1,565 decrease in pole and small sawtimber size class stands. Stand densities would decrease as a result of treatments. A more detailed breakdown of changes in CWHR size class can be found in the wildlife report located in the planning record.

Alternative 4

Thinning would change the distribution of CWHR size classes. There would not be an increase in seedling size class stands. There would be an increase of 269 acres in the medium/large size class stands, and a decrease of 3,910 acres in pole and small sawtimber size class stands. Stand densities would decrease as a result of treatments. A more detailed breakdown of changes in CWHR size class can be found in the wildlife report located in the planning record.

Cumulative Effects to Age Class Distribution

Alternative 1

Relative age class distribution within the project area would remain unchanged. Conifer stands that are currently overstocked would remain so for an indefinite period of time or until wildfire and/or insects or other disturbance eventually creates openings by which new age classes could become established. There would also be a high risk of total loss to the above mention disturbances as overstocked conditions persist jeopardizing existing age class distribution in potentially very large areas. There would be an increase of large and small surface fuels as mortality and self pruning increased due to overstocked conditions further increasing risk of total loss. The potential loss of large areas of existing age classes would create more early seral stage on the landscape within the project area but the juxtaposition of age classes could increase substantially. Within overstocked areas overall growth would be reduced which would in turn reduce diameter growth lengthening the amount of time it would take for trees to become large increasing CWHR size class. Within overstocked areas CWHR density class would lower as tree mortality occurs but fuel loading associated with mortality would also increase. Shade intolerant species would continue to decline until disturbance occurs.

Alternative 2

The amount of time for stands to reach larger size would be increased as reduced stand densities would improve stand growth and health. The probability of density induced mortality would be reduced for approximately 20 years, and stands would have reduced ladder fuels from existing for approximately 15 to 20 years reducing the threat of total loss to wildfire.

Alternative 3

Age class distribution would increase early seral stage of ponderosa pine by 514 acres. There would be an increase in size class from 11-24 inch d.b.h. trees> 24 inch d.b.h. trees as a result of thinning. Stands would still consist of young and middle-aged forests of small and medium-sized trees in early to mid seral stages. There would be an increase in stands 11-24 inches d.b.h. with canopy closure less than 40 percent and a decrease of stands 11-24 inches d.b.h. with 40-60 percent canopy cover from thinning.

Alternative 4

Treatments planned in alternative 4 would change the size class of numerous stands. Thinning in the area thinning and DFPZ treatments would remove smaller trees and result in greater average stand diameters. The treatments would also indirectly affect the future size classes by decreasing stocking which would allow for increased individual tree diameter growth. Over time, alternative 4 would result in larger diameter stands compared to no treatment with the exception being areas with high densities of trees with diameters exceeding harvest limits which would have reduced diameter growth.

There would be more area remaining at high densities (canopy cover would not be reduced below 70 percent) than the same treatment areas under alternatives 2 and 3. The number of young seral stage acres would not increase as compared to alternatives 2 and 3. Small to medium sizes trees thinned to below 40 percent canopy cover are expected to increase densities within the next ten to twenty years as the canopies of stands fill in.

Insect and Disease

Direct and Indirect Effects

Alternative 1

Annosus (*Heterobasidion spp.)* root disease is present in stands throughout the project area. The disease is normal in forest ecosystems and contributes to wood decay, decreased growth, tree mortality, and predisposition to bark beetle attack (Schmitt et al. 2000). Crowded stands containing a large percentage of true fir almost always contain some amount of annosus root disease. The disease decays tree roots. When the roots die faster than they can regenerate due to slowed growth from inter-tree competition, the tree will fall over and/or die. Annosus root disease spreads by root to root contact of trees of the same species, and through aerial infection via fresh wounds in tree boles or freshly cut stumps. Pines and incense cedar are resistant to the strain that infects white and red fir. Historically the forest contained proportionately more resistant tree species.

Bark beetles are native pests that kill conifers. The Creeks II project area contains normal endemic insect top kill and whole tree mortality that is usually associated with diseased, damaged, overmature, or stressed trees. There are a number of bark beetle species present and active within the project area including: mountain pine beetle, western pine beetle, Jeffrey pine beetle, fir engraver beetle, and pine engraver beetle. Stands that grow increasingly dense increase in the risk of experiencing widespread mortality, generally from a complex of factors that includes a population outbreak of bark beetles. Typically, widespread bark beetle attacks occur in dense stands in conjunction with drought conditions when trees are already under stress. This combination provides a large potential food base of weakened trees. When bark beetles successfully infect a tree, they emit attractant chemicals that will attract other nearby bark beetles.

White pine blister rust is present in the project area. The disease is specific to the five needle pines, sugar pine and western white pine. Infections are scattered throughout the area and occurs in all tree sizes. The disease often kills younger trees and may kill tops or reduce growth and vigor of older trees.

Dwarf mistletoe (*Arceuthobium spp*.) infection occurs throughout the project area and the most common dwarf mistletoe specie infects red and white fir. Most inventoried stands show light to moderate levels of infection. Moderately dense white fir and mixed conifer stands would support the spread of mistletoe because susceptible host trees are in close proximity to one another. Dwarf mistletoe does not spread well in extremely dense stands however because host vigor and subsequent dwarf mistletoe seed production is low. Stands that are predominantly stocked with susceptible host trees (true fir) or have heavily infected trees in the overstory will develop increasing levels of infection. Mistletoe spreads from tree to tree and especially from overstory to understory trees. Dwarf mistletoe infection will spread through an even aged stand roughly two feet per year and more quickly when overstories are infected in multi-storied stands. With no treatment and continued wildfire suppression, levels of mistletoe infection would increase and mistletoe would spread. Infection by dwarf mistletoe causes mortality, reduced growth rates, loss of vigor, reduced cone and seed production, and increased susceptibility to other damage agents such as bark beetles (Filip et al. 2000). Severely infected trees can experience as much as a 40 percent growth loss.

Heart rot is common throughout stands, especially in older red and white fir trees. Rot also occurs in pines, incense-cedar, and Douglas-fir; however, these species are less susceptible. Fir trees are susceptible to brown and white rots caused by fungi. Fungi infect the trees through wounds caused by fire, frost cracks, lightning and mechanical damage. Thrifty, uninjured young fir trees are generally free from heart rot, but rot is common in overmature trees (Kimmey and Bynum 1961).

Alternatives 2-4

Thinned stands would increase in overall forest health. Commercial thinning (area thinning and DFPZ thinning) would target the removal of damaged and diseased trees and favor retention of trees free of damage and defect.

Thinning would favor the removal dwarf mistletoe infected trees; however, to maintain desired stocking and canopy cover, some infected trees would remain in the stands. Remaining infected overstory trees would continue to serve as a source for the infection of adjacent and understory trees. Group selection may also decrease levels of overall stand infection by removing individual infected trees and pockets of infected trees; however, infected trees 30 inches d.b.h. and larger retained within groups as well as other infected trees remaining on the edge of groups would serve as a host and spread mistletoe to regeneration in the group area.

Thinning should decrease stand mortality caused by bark beetles. Thinning would remove diseased and injured trees, which are most susceptible to bark beetle caused mortality (Demars and Roettgering 1982; Ferrel 1986; Kegley et al. 1997; Smith 1971), and also reduce tree competition, which can improve resistance to beetle caused mortality.

Harvest treatments have the potential to increase populations of the pine engraver beetle, *Ips pini*. Large populations commonly infest logging slash, windthrown trees, or trees broken by wind or snow. When populations are low, the beetle may kill or top-kill widely scattered single trees or small groups of trees. However, if large populations build, mortality of live trees can become epidemic. Proper slash treatments such as whole tree yarding, chipping, and piling and burning, and timing of treatments should minimize the slash and downed logs that serve as suitable habitat and maintain populations at endemic levels (Kegley et al. 1997). The proposed action includes slash treatments designed to minimize habitat for the pine engraver beetle. Timber sale contracts also have standard provisions that control timing of activity slash treatment.

Prescribed burning can cause residual trees to be susceptible to beetle attack particularly if they are weakened from fire-related damage to the cambium or crown. Trees may be susceptible to bark beetle attack for several years after burning. Prescribed fire intensity may be less where mechanical machine piling or mastication treatments are used initially, resulting in less potential for fire related injuries and bark beetle attack. There is the potential to cause basal wound damage to residual trees during mechanical treatments. These types of injuries, when small in size and numbers, would generally not increase a stands susceptibility to bark beetle attack. The beneficial effects to conifers from prescribed fire include increased nutrient availability and reduced risk of damage or loss to wildfires.

Annosus root disease is caused by the fungus *Heterobasidion spp.* and is found in all western conifer species. Annosus is present in the Creeks II project area. Annosus root disease spreads from root to root contact as well as from infection by airborne spores. Long distance spread can occur when airborne spores contact and infect fresh exposed wounds and stump surfaces (Schmitt et al. 2000). Infection by *Heterobasidion Sp.* may become more wide spread if stumps are not treated. This would make the long-term control of annosus root disease more difficult and may impact previously unaffected stands, as well as adjacent landowners. The disease could create infection centers where trees of susceptible species would begin to display effects ranging from reduced individual tree vigor, root and bole decay, windthrow, root mortality, and tree mortality. The infection centers would create localized pockets of dead and down trees which would contribute to higher surface fuel accumulation in the future. There are no proven methods for eradicating this disease on a site

When applied properly, the use of an EPA registered borate compound, Sporax has been shown to be up to 90 percent effective at preventing new infections of annosus root disease on stump surfaces (Schmitt et al. 2000). All action alternatives propose to apply Sporax to all cut stumps of all trees with a stump diameter 14 inches and larger to protect against the spread of annosus root disease. Approximately 8,060 acres of proposed thinning and group selection treatments would include harvest of trees 14 inches and larger. The use of sporax has been analyzed for environmental risk and human health and safety within the Creeks II project. Control measures to protect aquatic features and TES plants are described in the integrated design features for the proposed action. Applications of Sporax within the Creeks II project would follow all applicable Federal and California rules and regulations, including requirements for worker protection, storage, and environmental protection Toxicity and application rates of Sporax as well as alternative control methods considered are discussed further in the silviculturist report.

Alternative 3 would include the use of Sporax as described and analyzed under alternative 2. Approximately 216 additional acres would be treated with Sporax. Thinning, group selection, and RHCA treatments would occur on approximately 8,276 acres that would include harvest of trees greater than 14 inches d.b.h. and the application of a borate compound (Sporax). No Sporax would be applied within aspen treatment units or within 25 feet of known sensitive and special interest plants or within 25 feet of standing water.

Alternative 4 effects would be the same as those described under alternative 2 and 3 with 1,282 acres and 498 acres less treatment. Although some areas with trees exceeding harvest diameter limits would be retained at high densities. Within these high tree density areas there would be potential for higher than normal mechanical damage to residual stands that could increase pathogen infection rates resulting from exposure of cambium.

Cumulative Effects

Previous timber harvest has selectively removed dwarf mistletoe (*Arceuthobium spp.*) from stands. However, because mistletoe is so widespread it is rarely if ever completely removed from a stand. The most common dwarf mistletoe in the project area infects true fir and is the species discussed for analysis. Shelterwood and other multi-storied stands that have or develop mistletoe in the overstory will spread the disease to the regeneration growing below. Maintaining a species mix so that non-host trees provide some physical barrier between susceptible trees, as well as selectively removing heavily infected trees, particularly in the overstory, helps prevent the development of undesirable infection levels in a stand. Earlier harvest treatments over the last 30 years provided some control for the spread of dwarf mistletoe as heavily infected trees were targeted for removal. More recent thinnings and treatments proposed in this project may have a lesser effect of managing the spread of dwarf mistletoe due to prior and existing management direction that prohibits the removal of larger trees that may otherwise be heavily infected with dwarf mistletoe. Dwarf mistletoe infection levels may be decreased in the short term alternatives 2-4 but are likely to increase over time throughout much of the project area as infected overstory trees remain on site and the relative proportion of susceptible host trees remains high in many stands.

There are 8,848 acres of CWHR class 4M and 5M within the project area not proposed for DFPZ or area thinning. Approximately half of these stands are expected to be at densities at or above 60 percent of maximum stand density index. There are also 5,492 acres of CWHR 4D and 5D within the project area not proposed for DFPZ or area thinning. Virtually all of these stands are expected to have densities above 60 percent of maximum stand density index. These stands are at risk of widespread mortality from insect attack or drought. Typically, widespread bark beetle attacks occur in dense stands in conjunction with drought conditions when trees are already under stress. These stands are also increasingly likely to experience complete mortality under typical late summer wildfire conditions, particularly as fuels continue to accumulate. A summary of the acres of CWHR classes 4M, 4D, 5M and 5D not proposed for treatment and their current management status are listed in Table 40.

Table 40. Summary of acres of CWHR 4M, 4D, 5M and 5D not proposed for treatment under the proposed action

CWHR Class	Current Management Allocation	Acres
4D	Owl and/or Goshawk PAC[a]	2,314
	Roadless (RAREII)	90
	Other	2,984
4M	Owl and/or Goshawk PAC	1,887
	Roadless (RAREII)	91
	Other	5,597
5D	Owl and/or Goshawk PAC	0
	Roadless (RAREII)	0
	Other	104
5M	Owl and/or Goshawk PAC	553
	Roadless (RAREII)	10
	Other	710

Source: 1993 Lassen Forest Plan, Appendix U and Updated Almanor Ranger District Vestra Veg Layer
a – PAC = protected activity center

Economics

The social and economic environment of the Lassen National Forest is described in the Forest's 1993 Forest Plan, as amended by the 1999 ROD for the HFQLG Act FEIS and ROD; and the 2004 SNFPA FSEIS and ROD. This economic analysis is not designed to model all economic factors used in an intensive and complex timber sale appraisal process. This economic analysis takes a less complex but consistent and systematic approach to display the relative differences in financial efficiency (i.e. relevant revenues and costs) for the alternative.

The geographic boundary for the social and economic analysis for the HFQLG Pilot Project encompasses the counties located within the core and peripheral areas (HFQLG FEIS, appendix S, p. 7; map 1 in appendix C of this FSEIS). The core area of the HFQLG region includes the Creeks II project area. This economic analysis will be based on the incremental effect of the Creeks II project within the HFQLG Pilot Project region.

The HFQLG Act is in response to the Quincy Library Group Community Stability Proposal. The Act expects that harvesting associated with commercial thinning and group selection will contribute to community stability.

The economic analysis will not revisit information presented in the HFQLG FEIS but will focus on the time frame associated with implementing thinning and fuels reduction for the Creeks II project. The time frame for completing timber removal would take approximately 5 years. Completion of DFPZ construction activities would take an additional 3 to 5 years after harvest.

Measurement Indicator

The monetary value of each alternative depends on the amount and method of timber harvest and the acreage planned for fuels reduction treatments. Areas with positive timber harvest values would pay for associated fuels reduction activities on those acres. Fuel reduction costs that exceed harvest revenues would become service contracts to be financed through appropriated funds when available.

Desired Condition

The Creeks II project would contribute to community stability by providing employment and a wood supply for local manufacturers who rely on federal timber to keep local mills in operation.

Direct and Indirect Effects

All costs and values are not represented in the economic analysis. Calculations do not include costs and values for those items that cannot be estimated in dollar terms or easily estimated such agency administration. The analysis does not take into account non-priced benefits such as long-term wildlife habitat, improved watershed conditions, control of noxious weeds, and reduced fire hazard. Table 41 shows the benefit/cost ratio by alternative.

The increase in post-harvest fuels treatment acres of grapple piling combined with relatively small acreage increases of mastication, pile burning, and broadcast burning combine to give alternative 3 a lower positive return when compared to alternative 2 even though alternative 3 has slightly more forest product and a higher total value.

Table 41. Creeks II project benefit/cost ratio

Alternative	Benefit	Cost	Net Present Value	Benefit/Cost Ratio[a]
1	0	0	-	-
2	$8,307,089.70	$ 4,064,660	$4,242,429.10	2.04
3	$8,504,562.30	$4,550,473.40	$3,954,088.90	1.87
4	$4,951,568.40	$3,136,558.30	$1,815,010.10	1.58

a - 1.0 = break even; > 1.0 = positive return; < 1.0 = negative return

Benefits

Under alternatives 2-4 trees harvested would be commercially sold as appropriate. See Table 42 for predicted amount and value of timber estimated by alternative. Timber harvest values utilized for this analysis are a three-year weighted average of the value of similar sold timber sales on the forest. Timber volume estimates are based on modeling of stand exam data in FVS and cruised (sampled to Region 5 standards) volume.

Table 42. Estimated total timber yield and value by alternative

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Saw Timber	Total volume in CCF[a]	0	85,640	87,676	40,575.90
Non Saw		0	24,155	24,729	24,869.10
Total Value		0	$8,307,090	$8,504,562.30	$4,951,568.40

Saw timber includes trees equal to or larger than 10 inches d.b.h.
Non saw timber includes trees 3-9.9 inches diameter
a – CCF = hundred cubic feet

Employment

Table 43 compares employment related impacts of alternatives 1-4.

Under alternative 1critical fuel loading would not be reduced and harvest of forest products would not occur. No funds would be generated to pay for fuel reduction. No additional employment opportunities or wages paid to primary and service industry employees would be circulated through the local economy.

Alternative 1 would result in a negative effect on local industries that depend on service contracts or a steady supply of forest products, as well as counties that use timber yield taxes to fund county programs. These local industries currently lack opportunities related to fuels reduction, site preparation, and timber harvest activities. The local economy would also not receive benefits from associated employment such as in food, lodging, and transportation businesses. Throughout northern California cumulative years of reduced timber harvesting activities, particularly on federal lands, have resulted in the loss of infrastructure to complete such activities. The loss of such infrastructure, including local mill closures, could significantly reduce or eliminate future economic and environmental opportunities from National Forest System lands. The continuation of current conditions under the no-action alternative would preclude opportunities for long-term employment and rural community stability because fuel reduction activities related to the creation and maintenance of Defensible Fuel Profile Zones (DFPZs) as well as forest restoration would not occur.

Under alternatives 2-4, employment opportunities can have direct, indirect, or induced effects on the local economy. Direct effects are associated with the primary producer. For example, the manufacturing of lumber from the Creeks II project has a direct effect on employment opportunities. Indirect effects account for employment in service industries that serve the lumber manufacturer. These industries may include logging, trucking, fuel supplies, etc. Induced effects are determined by wages. Wages paid to workers by the primary and service industries are circulated through the economy for food, housing, transportation, and other living expenses. The sum of direct, indirect, and induced effects is the total economic impact in terms of jobs. This typically ranges from 10 to 15 jobs per 2,000 hundred cubic feet (13 jobs/2,000 hundred cubic feet for this analysis).

The sum of direct, indirect and induced effects is the total economic impact in terms of jobs. In addition to the direct employment that would result from the harvesting and fuel reduction treatments in alternatives 2-4, there would be some additional benefits to the local economy as wages earned by those employees are spent on living expenses.

Alternatives 2-4 would provide timber yield tax, administered by the State Board of Equalization. This tax is not paid by the Forest but is paid by private timber operators and is based on the amount of timber harvested in a given year on both private and public lands. The tax is 2.9 percent of the value of the harvested timber. The taxes are collected by the state, and approximately 80 percent is returned to the counties in which the timber was harvested.

Table 43. Comparison of economic impacts of alternatives 1, 2, 3, and 4

Employment	Alternatives			
	1	2	3	4
Direct jobs	0	343	351	204
Indirect jobs	0	371	380	221
Total direct and indirect jobs	0	714	731	425
Total employee related income	0	$31,278,399.00	$32,021,936.00	$18,643,971.00

Costs

Table 44 and Table 45 show costs by alternative. Costs are associated with reforestation and post-harvest fuels treatments. Cost of mechanical fuels treatment and site preparation, manual tree planting, manual and mechanical seedling release, manual site preparation and fencing, and prescribed fire are based on most recent service contract prices and Knutson-Vandenberg (KV) brush disposal and sale area improvement plans. Various habitat and resource improvement opportunities which are not funded from the project's timber sale receipts may be funded through other sources such as watershed improvement needs.

Alternatives 1 and 4 do not have essential reforestation costs because no regeneration treatments are proposed under those alternatives.

Alternative 1

Under the no-action alternative, wildlife habitat, and riparian habitat restoration and enhancement could not occur without appropriated money from Congress. In addition, dense standing trees and down woody material in the Creeks II project area would continue to pose a very high fire hazard to critical habitat and the local community. If the no-action alternative were implemented, additional money would be needed to conduct any fuel reduction treatment as well as possible substantially increased fire suppression costs should a large wildfire occur in the Creeks II project area. Should wildfire occur, costs incurred from potential fire fighter fatalities/injuries, loss of facilities, and post-fire tree regeneration and watershed rehabilitation costs would also likely be higher than under the action alternatives.

Alternatives 2-4

The analysis predicted a positive return for alternative 2 and 3 proposed treatments. Trust funds from the sale of timber would be used to complete reforestation for alternatives 2 and 3 and post harvest fuels treatments for alternatives 2, 3 and 4. There would be an economic return of money to the community from associated harvesting activities, processing and sale of forest products, and from service contracts awarded to complete both essential reforestation and post harvest treatments. After all timber sale area improvement projects have been funded and other trust fund obligations have been met (i.e., National Forest Foundation), the remaining balance would be returned to the U.S. Treasury.

Table 44. KV essential reforestation costs by alternative

	Alt 1	Alt 2	Alt 3	Alt 4
Treatment	**Total Future Costs**			
Group Selection Site Prep-Tractor	0	$265,408.00	$273,702.00	0
Group Selection Site Prep-Pile Burn	0	$56,358.40	$57,239.00	0
Group Selection Site Prep Subsoil)	0	$25,277.60	$25,277.60	0
Tree Planting	0	$322,182.40	$332,250.60	0
Manual/Mechanical Seedling Release)	0	$192,000.00	$192,000.00	0
Animal Control/Vexar & Gopher Trapping	0	$67,500.00	$67,500.00	0
Temporary Aspen Fencing	0	$45,502.50	$45,502.50	0
Manual Aspen Release	0	$52,500.00	$52,500.00	0
Total	0	$1,026,728.90	$1,045,971.70	0

The following post harvest treatments (Table 45) for alternatives 2, 3 and 4 would be accomplished using trust funds from the sale of timber. Alternatives 2-4 would meet economic and social requirements of the HFQLG Act.

Table 45. Post-harvest treatments

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Treatment	**Total Future Costs**			
Post Harvest Machine Piling	0	$1,619,008.50	$2,042,696.00	$1,841,764.10
Mechanical Mastication within Plantations	0	$484,189.56	$504,071.74	$467,231.23
Broadcast Burning	0	$334,190.00	$342,010.00	$305,555.00
Pile Burning	0	$580,244.00	$595,424.00	$522,008.00
Road Decommissioning	0	$11,600.00	$11,600.00	0
Road Drainage Crossing Improvement	0	$8,700.00	$8,700.00	0
Total	**0**	**$3,037,932.00**	**$3,504,501.70**	**$3,136,558.30**

Cumulative Effects

Alternatives 2-4 would result in a positive effect on local industries that depend on service contracts or a steady supply of forest products, as well as counties that use timber yield taxes to fund county programs. These local industries currently lack opportunities related to fuels reduction, site preparation, and timber harvest activities. The local economy would receive benefits from associated employment such as in food, lodging, and transportation businesses. The alternatives would have a positive effect on maintaining local infrastructure that is imperative to implementing future fuels reduction projects. The alternative would provide opportunities for long-term employment and rural community stability because fuel reduction activities related to the creation and maintenance of Defensible Fuel Profile Zones (DFPZs) as well as forest restoration could continue into the future.

Alternatives 2-4 include increased overall economic activity in the HFQLG Pilot Project Area. Though it is not a requirement, it is assumed in this analysis that most of the products from HFQLG projects will be processed locally due to high hauling costs of products and equipment. It is also assumed that employment will be derived from Plumas and Lassen counties. The action alternatives would provide revenues from timber and service contracts that would complement all other HFQLG funded projects across the forest and HFQLG region.

Transportation

Introduction

Analysis was driven by road-related resource area concerns and opportunities to accomplish project needs, and to integrate riparian and watershed improvements in locations that road use would be needed for project implementation. Unauthorized routes in the analysis area were analyzed for temporary use, addition to Forest transportation system, or decommission based on needs for future use versus the negative impacts to resources.

Management Direction and Laws

All action alternatives are in compliance with the transportation objectives found in the Lassen Forest Plan as amended.

Measurement Indicators

Road density is discussed under the watershed and fisheries section. There are no other measurement indicators related to transportation.

Affected Environment

Existing Condition

The analysis area contains a number of National Forest System (NFS) roads ranging from smooth gravel–surfaced roads to rough, primitive, and un-surfaced roads. Most of these system roads were planned and constructed during past commercial timber harvest activities and most are not considered to be all weather roads.

Main forest system roads link with county roads which link to double-lane paved State highways to form a transportation system that provides access to National Forest System lands for a variety of uses from towns and communities in the surrounding area. Traffic is normally low in the project area, and most traffic originates from timber, recreation, and grazing activities.

National Forest System roads within the analysis area are managed in accordance with current management objectives that are based on a variety of needs for access and use of forest resources. This area contains roads that are operated and maintained by the Forest Service for use by high clearance vehicles and non-motorized uses such as hiking, horseback riding and cross-country skiing.

In order to achieve the recommended vegetation management treatments while minimizing impacts to water quality, Best Management Practices (BMPs) would be used during road construction, road maintenance, and logging operations (pre-haul through post-haul).

Desired Condition

From a transportation standpoint, the desired future conditions involve a network of roads that provides safe access for vegetation/ fuels treatment, fire suppression, administrative needs, and public use. Maintenance in accordance with the road objective maintenance levels is recommended.

Road Development Plans

Arterial/Collector

The existing transportation system is adequate for the ongoing activities. No further developments are planned on this project.

Local Roads

The existing roads consist of National Forest System roads and inventoried unauthorized routes. The existing National Forest System roads were initially developed primarily to accommodate log trucks only, and in some cases would require reconstruction/realignment in order to accommodate chip vans. Within the project area there are approximately 11 miles of unauthorized routes. Unauthorized routes are remnants of past cultural settlement, land management practices or may be user-created by the public and do not have maintenance performed and are not part of the National Forest System. Two general recommendations are made for the inventoried unauthorized routes. The first option is to bring the unauthorized route into the National Forest transportation system for long-term availability. These roads would generally be managed as maintenance level 1 road (kept in long-term storage except when periodically used for administration of National Forest System lands) and as maintenance level 2 roads (open, low standard roads maintained for periodic high clearance vehicle traffic). The second option is decommissioning unauthorized routes that are not needed for long term management and use of National Forest System lands. Decommissioning of unauthorized routes can follow temporary use, such as utilization for a timber sale activity. It should be noted that decommissioning has a variety of physical treatments; however, the routes are no longer considered “existing” and are no longer available for use.

There is also a need for temporary roads in order to access certain treatment areas. There are no long term needs for roads in these areas, thus the strategy would be to decommission temporary roads at the conclusion of their use on this project.

Environmental Consequences

Direct and Indirect Effects

Alternative 1

Under this alternative, no treatments would be performed and the existing road system within the project area would remain as is. There would be no direct or cumulative effects. Unauthorized routes within the analysis area would remain on the landscape. No progress would be made towards the established objective maintenance levels of National Forest System roads. A forest road maintenance program that is currently under funded would not receive supplemental maintenance on National Forest System roads. Roads would continue to deteriorate through use by high clearance vehicles, off-highway vehicles (OHV) riders, mountain bicycles, etc. without concurrent maintenance and upkeep. Some of these roads could possibly deteriorate to the point where they would no longer be accessible to high clearance vehicles, including fire suppression equipment. This would limit ingress/egress for firefighting ground resources and would therefore reduce firefighter safety.

Alternative 2 and 3

Alternatives 2 and 3 include transportation recommendations to actively manage the forest transportation system within the project area. Proposed road activities are the same for these two alternatives. This would include maintenance, reconstruction, decommissioning, and construction of roads. Road related watershed improvement work would also be performed on multiple roads and drainage crossings within the project area. This work would include upgrading culverts, surfacing crossings, out-sloping sections of roadway, constructing low water crossings, and removing unneeded crossings.

Approximately 1.9 miles of unauthorized route would be upgraded to Forest transportation standards and added as National Forest System roads. These routes were determined to have long-term needs for future management. Approximately 5.2 miles of unauthorized route are needed to access treatment units for this entry only and would be utilized as temporary roads and decommissioned upon project completion. Approximately 6.5 miles of unauthorized route was determined to have no immediate or long-term future management needs and would be decommissioned. Approximately 1.0 miles of an existing unauthorized OHV trail would be decommissioned.

Approximately 1.6 miles of National Forest System maintenance level 2 road would be reclassified as maintenance level 1 road once the project is complete. ML1 roads are closed to all motor vehicle traffic, but retained on the National Forest System to facilitate future management activities. A total of approximately 4.6 miles of existing National Forest System road would be decommissioned as they are not needed for long-term future management. Approximately 2.9 miles of National Forest System road will receive reconstruction prior to hauling, and seventy-two drainage crossings will receive aggregate spot-surfacing in order to reduce sediment delivery to the channel.

Approximately 3.57 miles of new temporary road would be constructed for access during project implementation. These temporary roads would then be decommissioned upon project completion.

Table 46. Summary of transportation actions for alternatives 2 and 3

Action	Miles
New Road Construction (existing unauthorized route)	1.9
New Temporary Road Construction	3.6
Decommission	11.1
Reconstruct Existing NFS Road	2.9
Proposed Maintenance Level 1[a]	1.6
Use as Temporary Road then decommission[b]	5.2
Decommission Unauthorized OHV Trail	1.0
Road Surfacing	7.3
Road Crossing Surfacing	72 crossings

a - Existing NFS Maintenance Level 2 road.
b - Existing unauthorized route.
Source: Lassen National Forest Transportation GIS (Creeks II Road treatment)

All National Forest System roads used for hauling would receive pre, during, and post haul maintenance as per Forest Service Road Maintenance T-Specifications for Timber Sale Contracts as needed. The road maintenance on this project would supplement a forest road maintenance program that is currently underfunded. A dust abatement plan would also be included to control wind-caused erosion from road use.

The proposed water sources for this project are located at:

- Upper Yellow Creek (T27N R5E SW1/4 Sec 34)
- Shanghai Creek (T27N R6E NE1/4 Sec 20)
- Water Creek (T26N R6E SE1/4 Sec 2)
- Rock Creek (T26N R6E NE1/4 Sec 7)

Alternative 4

Under this alternative the transportation activities would include maintenance, reconstruction, decommissioning, and construction of roads. Road related watershed improvement work would not be performed on roads and drainage crossings within the project area.

Approximately 1.9 miles of unauthorized route would be upgraded to Forest transportation standards and added as National Forest System roads. These routes were determined to have long-term needs for future management. Approximately 4.6 miles of unauthorized route are needed to access treatment units for this entry only and would be utilized as temporary roads and decommissioned upon project completion. Approximately 2.9 miles of National Forest System road would receive reconstruction prior to hauling in order to accommodate chip van traffic. Approximately 1.6 miles of National Forest System maintenance level 2 road would be reclassified as maintenance level 1 road once the project is complete.

Approximately 1.2 miles of new temporary road would be constructed for access during project implementation. These temporary roads would then be decommissioned upon project completion.

Table 47. Summary of transportation actions

Action	Miles
New Road Construction (existing unauthorized route)	1.9
New Temporary Road Construction	1.2
Reconstruct Existing NFS Road	2.9
Use as Temporary Road then decommission[b]	4.6

a - Existing NFS Maintenance Level 2 road.
b - Existing unauthorized route.
Source: Lassen National Forest Transportation GIS (Creeks II Road treatment)

All National Forest System roads used for hauling would receive pre, during, and post haul maintenance as per Forest Service Road Maintenance T-Specifications for Timber Sale Contracts as needed. A dust abatement plan would also be included to control wind-caused erosion from road use. The proposed water sources for this alternative would be the same as alternative 2.

In the short term there would be a direct effect of increasing traffic due to the movement of equipment, materials and personnel into and out of the project area. Increase traffic can impact the safety of the public and employees using the roads in the area. Traffic management measures will minimize these impacts. With the use of standard contract provisions for traffic control, effects would be negligible.

For the short term during the sale contract, depending on the length and timing of the project, there will be the potential of erosion from the construction of new temporary roads. There will need to be provisions in the contracts to require erosion control measures in case seasonal closures are needed. For the long term temporary roads will be decommissioned after haul operations or post sale activities are completed.

Cumulative Effects

Long-term road maintenance costs and responsibilities would be reduced due to a net loss of specified road miles that would need to be maintained. Long-term costs would also be reduced by road reconstruction and surfacing activities, as these activities would aid in 'storm-proofing' roads which typically leads to a reduction of road drainage structure failures in major storm events, and a less frequent routine maintenance schedule.

Botany

Introduction

This analysis documents the potential effects of this project activities on nine Forest Service Region 5 sensitive plant species (see Table 48). Currently only four of the species have been found within the project area. Although potential habitat for the remaining species exists within the project area, no known occurrences of these species were located during surveys.

The botany biological evaluation (planning record) provides additional detail on all species considered for analysis but dropped due to lack of habitat. No other currently listed Forest Service sensitive plant species are known or have potential habitat within the project area. No threatened or endangered plant species occur within the project area, and they will not be considered further in this analysis.

Table 48. Sensitive plant species considered for analysis within the Creeks II project

Species	Status[a]	Considered	Reasons
Botrychium ascendens – upswept moonwort	S	Yes	Springs, seeps, and streambanks in mixed coniferous forests well surveyed and species not found, but potential habitat exists within project area; 5200-6240 ft.
Botrychium crenulatum – scalloped moonwort	S	Yes	Springs, seeps, and streambanks in mixed coniferous forests well surveyed and species not found, but potential habitat exists within project area; 5040-6000 ft.
***Botrychium minganense* – Mingan moonwort**	**S**	**Yes**	**Species present**
***Botrychium montanum* – western goblin fern**	**S**	**Yes**	**Species present**
***Meesia triquetra* – Meesia moss**	**S**	**Yes**	**Species present**
***Meesia uliginosa* – Broad-nerved hump moss**	**S**	**Yes**	**Species present**
Oreostemma elatum – Plumas aster	S	Yes	Habitat of westside fens or very wet meadows well surveyed and species not found, but potential habitat exists within the project area; 3800-6200 ft.
Silene occidentalis ssp. longistipitata – long-stiped campion	S	Yes	Habitat of openings in mid-elevation mixed coniferous forests moderately well surveyed and species not found, but potential habitat exists within project area.4500-6100 ft

S = Forest Service sensitive

Management Direction and Laws

All the alternatives analyzed for the Creeks II project are consistent with the Forest Plan and other direction, including conservation strategies, with regard to rare plants and their habitats. Under these alternatives, sensitive plant species and habitats are protected (albeit to differing degrees) as needed to maintain viability.

Methodology

The analysis of effects on Lassen National Forest sensitive plant species was a three-step process. In the first step, all listed or proposed rare species that were known or were believed to have the potential to occur in the analysis area were identified. This list was developed by reviewing Regional Foresters Sensitive Plant List (USDA Forest Service 2006), Lassen National Forest sensitive plant records from 1987-2010 (USDA Forest Service 2010), the threatened, endangered, sensitive (TES) geodatabase (USDA Forest Service 2010), as well as California Natural Diversity Database records (CDFG CNDDB 2010).

The second step was field reconnaissance surveys. Field surveys were conducted in accordance to California Native Plant Society (CNPS) Survey Guidelines (2001) in all areas proposed for treatment and believed to have potential habitat for sensitive plants. Field surveys were conducted specifically for this project in 2004 and 2007 at the time of the year when plants were evident and identifiable. For each sensitive plant site found, information was collected that described the size of the occurrence, location and habitat characteristics, and any existing or potential threats were identified. Additionally, information on plant data from past field surveys, monitoring, and personal field observations was also utilized during the analysis. Additional information on data sources can be found in the botany biological evaluation in the planning record.

All of this information was used in step three of the analysis, where data was imported into one or more Lassen National Forest GIS databases and used to analyze potential impacts to sensitive plant species and fens within the project area and to develop integrated design features used in development of alternatives.

Incomplete and unavailable information

While these species are being analyzed as having potential habitat within the project area, there is no definitive knowledge of why they were not found during surveys, and where all potential habitats exists within the project area. Only general assumptions about habitat needs are discussed in regard to those species found outside of fen habitats, since not enough is understood about the specific habitat requirements for a detailed discussion of project level effects.

Affected Environment

Existing Condition

There are currently four Region 5 sensitive plant species found within the project area: *Botrychium montanum* (western goblin), *B. minganense* (Mingan moonwort), *Meesia triquetra* (three-nerved hump-moss) and *Meesia uliginosa* (broad-nerved hump-moss). *Botrychium montanum* is known to one occurrence within the project area at Milkhouse Flat; however, this occurrence was not relocated during recent surveys in 2009. *Botrychium minganense* is known to two locations in the project area at Milkhouse Flat and Little Grizzly Fen. Two individuals were found at Milkhouse Flat in 2004; however, these were also not seen during a follow-up visit in 2009. The Little Grizzly Fen occurrence ranges between three and 11 individuals (USDA Forest Service 2010).All known occurrences of *Botrychium minganense* and *B. montanum* are found outside of proposed treatment units. Wet areas throughout the project area were surveyed for all *Botrychium* species, but no other occurrences were found.

The Creeks II project currently has 15 confirmed fens within the project area (Table 49). Fens are ecosystems with wet soils and an accumulation of peat or organic soils. Their permanent saturation creates oxygen-deprived soils with very low rates of decomposition, allowing the accumulation of organic matter produced by wetland plants (Weixelman and Cooper 2009). As a result, fens support a disproportionately large number of rare vascular and nonvascular plants species in the Sierra Nevada, making them important habitats for regional biological diversity (Weixelman and Cooper 2009).

Within the Creeks II project area various sensitive plant species have been found associated with fen and wet meadow habitats (Table 49). In addition, there are seven wet meadow that also contain many of the species and habitat characteristics found in known fens. As a result, these areas will also be protected with similar integrated design features as those confirmed fens within the project area.

Meesia triquetra is currently known to 17 occurrences within the project area. Of these, 12 are found within confirmed fens, while five are known to wet meadows (Table 49). In addition, surveys in 2007 located three occurrences of *Meesia uliginosa* within the project area, within Horseshoe and Slate Fens, as well as Upper Yellow Creek Meadow (Table 49).

Table 49. Fens and wet meadows with associated sensitive species found within the Creeks II project area

Fen Name	LNF occurrence[a]	Fen (Y/N)	Within Treatment Unit
Big Springs Fen	METR #2	Y	N
Elephanthead Fen	METR #22	Y	N
Grazed Willow Meadow	METR #25	N	N
Horseshoe Fen	METR #16 and MEUL #4	Y	Y (in part)
Huckleberry/3M Fens	METR #20	Y	N
Humbug Fen	METR #21	Y	N
Little Grizzly Creek CG Fen	METR #8	Y	Y
Little Grizzly Creek Fen	METR #1 and BOMI #7	Y	N
Little Smoochy Fen	METR #17	Y	Y
L-T Creek Fen	METR #18	Y	N
Miller Ravine Meadow	METR #14	N	Y
Mistletoe Fen	None	Y	Y
Mudhole Fen	None	Y	N
Newberry Meadow	METR #24	N	Y
Savanna Fen	METR #19	Y	N
Sawmill Tom Complex Meadow	METR #23	N	Y (in part)
Shanghai Fen	METR #13	Y	N
Sherman Meadow	METR #15	N	N
Slate Creek Fen	METR #7 and MEUL #5	Y	N
Upper Yellow Creek Meadow	MEUL #6	N	N
Yellow Fen	None	Y	N

a - METR – *Meesia triquetra;* MEUL- *Meesia uliginosa: BOMI- Botrychium minganense*

There are also three species of California Department of Food and Agriculture (CDFA) listed noxious weed species occur in the project area. Canada thistle (*Cirsium arvense*) is a CDFA-rated B species while both, bull thistle (*Cirsium vulgare*) and yellow starthistle (*Centaurea solstitialis*) are CDFA C-listed species. See the Creeks II project, noxious weed risk assessment for effects information on noxious weeds within this project, as hereby incorporated by reference.

Species Information

Botrychium ascendens

Botrychium ascendens is a small, primitive, perennial fern that is normally found in wet meadows or riparian habitats in coniferous forests at elevations from 5,000 to 6,000 feet (USDA Forest Service 2005b, CNPS 2001). *Botrychium ascendens* is widely distributed in Canada, Alaska, Montana, California, Nevada, Oregon, Wyoming, Idaho, and Washington, but is considered rare in many of these states (USDA Forest Service 2005b). There are currently only 19 occurrences of this species known to the state, found on the Inyo, Tahoe, Toiyabe, Sierra, Lassen, Modoc National Forests, as well as the Lake Tahoe Basin Management Unit (CDFG CNDDB 2010, USDA Forest Service 2010). There is also one occurrence found on private lands in the Lake Tahoe Region that was not relocated during surveys in 2002 (USDA Forest Service 2005b). Overall plant numbers within California are low and some of the occurrences are not confirmed (USDA Forest Service 2005b).

The Lassen National Forest currently has 10 known occurrences, but only three have been recently located and confirmed (USDA Forest Service 2010). Unfortunately, three of these sites have not been relocated since their discovery in 1985. Most occurrences are known to Willow and Jones Creeks on the Almanor Ranger District, but a large site (20 individuals) was recently found at Crazy Harry Gulch on the

Eagle Lake Ranger District. There is no formal monitoring in place for this species, and trends, long or short term, are unknown at this time.

Botrychium crenulatum

Botrychium crenulatum, scalloped moonwort, is a small, primitive, perennial fern, yellowish green in color, that is often associated with moist habitats in California including meadows, seeps and springs within coniferous forest habitats over 5,000 feet (CNPS 2001). *Botrychium crenulatum* is limited to the western United States, where it is scattered from California to Montana. It has the widest distribution in California of all the rare *Botrychium* spp., but is not known to be common anywhere, and most of the occurrences consist of only a few plants (USDA Forest Service 2005c). The California Native Plant Society ranks this species as List 2.2, and considers it endangered in California but more common elsewhere (CNPS 2010). Currently, there are approximately 48 occurrences of this species within California, found in scattered locations from the San Bernardino to the Modoc National Forests, and over to the Mendocino National Forest, where one occurrence has been found (USDA Forest Service 2010, CDFG CNDDB 2010).

On the Lassen National Forest there are 20 known occurrences, 17 of which are found on the Almanor Ranger District, on Willow, Jones, Martin, and Nanny Creeks as well as a tributary to Mill Creek and Cornelia Lott Sank (USDA Forest Service 2010). There is no formal monitoring in place for this species, and trends, long or short term, are unknown at this time.

Botrychium minganense

Botrychium minganense, Mingan moonwort, is a small, primitive, perennial fern, usually associated with riparian areas, small streams, or fens running throughout coniferous forests ranging from 5,000 to 6,000 feet in elevation (CNPS 2001). *Botrychium minganense* is known form scattered location throughout California to Arizona, Idaho, Nevada, Oregon, Utah, and Washington (USDA Forest Service 2005d). The California Native Plant Society ranks this species as List 2.2, and considers it endangered in California but more common elsewhere (CNPS 2010). Currently, this species is known to California from only 36 occurrences. One occurrence is known to each the Inyo, Modoc, San Bernardino and Tahoe and Sequoia National Forests (CDFG CNDDB 2010, USDA Forest Service 2010). In addition, there are also a few historical occurrences in Butte County, a report from the Sequoia National Park, and two known occurrences form the Plumas National Forest (USDA Forest Service 2005d, CDFG CNDDB 2010). Occurrences often consist of only a few plants so overall plant numbers in California are low.

There are currently 29 known occurrences of *Botrychium minganense* on the Lassen National Forest (USDA Forest Service 2010). Most are scattered throughout the Almanor Ranger District, but there is one occurrence on the Hat Creek Ranger District and five occurrences on the Eagle Lake Ranger District. There is no formal monitoring in place for this species, and trends, long or short term, are unknown at this time.

Botrychium montanum

Botrychium montanum, western goblin, is a small, primitive, perennial fern, found in varied wet habitats from marshes/meadows to coniferous forest/montane streamside areas, at elevations ranging from 5,000 to 6,000 feet (CNPS 2001). *Botrychium montanum* occurs in scattered locations from British Columbia to Montana, California, Oregon, and Washington (CNPS 2001). The California Native Plant Society ranks this species as List 2.1, and considers it seriously endangered in California but more common elsewhere (CNPS 2010). Currently, this species is known to California from only 39 occurrences, with one occurrence known to each of the El Dorado, Modoc, Plumas and Sierra National Forests (CDFG CNDDB 2010, USDA Forest Service 2010).

The Lassen National Forest has the most documented occurrences in the state, where it is currently known to 37 occurrences, but five occurrences have not been located since 1985 and are believed extirpated (USDA Forest Service 2010). Most of these occurrences are located on the Almanor Ranger District, but there are also four occurrences on the Eagle Lake District at Crazy Harry Gulch, Chaparral Hill, and Martin Springs, and the Hat Creek Ranger District has one occurrence at Cabin Springs. There is no formal monitoring in place for this species, and trends, long or short term, are unknown at this time.

Botrychium pinnatum

Botrychium pinnatum, Northwestern moonwort, is a small, primitive, perennial fernlike plant, found in seeps and along stream banks within coniferous forests, at elevations ranging from 5,600 to 5,860 feet (CNPS 2001). *Botrychium pinnatum* is limited to scattered locations, primarily in western North America from high elevations in east-central and northern California, northern Nevada, northern Arizona, Utah and Colorado to near sea level in Alaska and northwestern Canada (USDA Forest Service 2009). The California Native Plant Society ranks this species as List 2.3, and considers it rare in California but more common elsewhere (CNPS 2010). In California, it is very rare with only four confirmed occurrences throughout the state in Plumas, Modoc, Shasta and Siskiyou Counties (CDFG CNDDB 2010). The Modoc National Forest has one occurrence, while the Shasta-Trinity National Forest has one known occurrence discovered in 1994, and two historic occurrences. In addition, there is a historic occurrence outside of the Town of Etna on the Klamath National Forest, but efforts to relocate this occurrence have been unsuccessful. Occurrences often consist of only a few individuals, so overall plant numbers in California are low (USDA Forest Service 2005e).

The Lassen National Forest currently has two occurrences, one at Domingo Lake on the Almanor Ranger District, and one at Cabin Springs on the Hat Creek Ranger District (USDA Forest Service 2010). There is no formal monitoring in place for this species, and trends, long- or short-term, are unknown at this time.

Meesia triquetra

Meesia triquetra, three-ranked hump-moss, is a fairly large moss that grows in clumps within fen habitats. *Meesia triquetra* is found in bogs and fens, meadows and seeps, often in meadow openings surrounded by *Pinus contorta* from 5,000 to 10,000 feet (USDA Forest Service 2005a). *Meesia triquetra* is known from North America, Europe and Asia, but is most abundant in arctic regions. The California Native Plant Society (CNPS) ranks this species as a List 4.2 species, and considers it limited in distribution and fairly endangered in California (CNPS 2010). California populations are scattered throughout the state primarily within the Sierra Nevada and Cascade Ranges, though occurrences has also been found as far south as San Bernardino (USDA Forest Service 2005f). In California this species is known from approximately 120 occurrences, primarily within the Sierra Nevada (USDA Forest Service 2005f and 2010).Two historic occurrences outside the Sierra Nevada may be extirpated (USDA Forest Service 2005a).

On the Lassen National Forest, this species is known from 49 occurrences, primarily found in fen habitats all but one found on the Almanor Ranger District (USDA Forest Service 2010).

Meesia uliginosa

Meesia uliginosa, broad-nerved hump-moss, is a small moss that grows on decaying logs in fens and wet meadows in subalpine and upper montane coniferous forests from (CFDA CNDDB 2010, USDA Forest Service 2010). *Meesia uliginosa* is known from North America, Europe, and Asia (USDA Forest Service 2005a). It has a worldwide continuous circumboreal distribution, with disjunct populations in Tierra del Fuego, the Himalayas (Vitt 1992), and Antarctica (Ochyra and Lewis-Smith 1999). The California Native Plant Society ranks this species as a List 2.2 species, and considers it rare, threatened, or endangered in California but more common elsewhere (CNPS 2010). California populations are known from El Dorado, Fresno, Nevada, Plumas, Riverside, Sierra, Siskiyou, Tehama, Tulare counties (CDFG CNDDB 2010). In

California, this species is known from approximately 33 occurrences, with a majority found in the Sierra Nevada Mountains (CFDG CNDDB 2010, USDA Forest Service 2010). One historical occurrence outside the Sierra Nevada Mountains is believed to be extirpated (USDA Forest Service 2005a).

On the Lassen National Forest, this species is known from seven occurrences, all but one occurrence found within fens on the Almanor Ranger District (USDA Forest Service 2010).

Oreostemma elatum

Oreostemma elatum, (Plumas aster), is a perennial herb in the sunflower family wet meadows, fens and seeps within upper montane coniferous forests primarily in Plumas County (USDA Forest Service 2005g). The California Native Plant Society ranks this species as List 1B.2, and considers it a fairly endangered California endemic (CNPS 2010). Currently, this species is known to only 12 occurrences on the Plumas National Forest, one occurrence on the Tahoe National Forest and three occurrences on adjacent private lands (CDFG CNDDB 2010). There are no occurrences on Lassen National Forest lands despite the presence of potential habitat; however, there is an unconfirmed occurrence near Spencer Meadows just south of Lassen Volcanic National Park (CDFGD CNDDB 2010). All fens and wet habitats were surveyed within the project but no occurrences of this species were found.

The trend for this species is presently unknown. Monitoring of occurrences on the Plumas National Forest did not begin until 1997, but additional monitoring information is needed in order to determine long-term trends (USDA Forest Service 2005g).

Silene occidentalis ssp. *longistipitata*

Silene occidentalis ssp. *longistipitata,* (long-stiped campion) is a perennial herb that grows primarily in openings of upland mixed coniferous forests, on ridges, mid-slopes and toe-slopes, openings in true fir forests, and in rocky, sandy and often thin soils (USDA Forest Service 2007). The plants are normally in partial shade, but have been found in open, south facing clearcuts with few reserve trees (USDA Forest Service 2010). The California Native Plant Society ranks this species as List 1B.2, rare, threatened, or endangered in California and elsewhere and fairly threatened in California (CNPS 2010). The historic range of *Silene occidentalis* ssp. *longistipitata* is from northeastern Shasta County where there are two occurrences in the Goose Valley area to approximately 12 occurrences reported in to eastern Tehama County, northern Butte County, and northwest Plumas County; however, many of these occurrences have not been relocated since their discovery (USDA Forest Service 2007 and 2010).

Currently, there are 10 occurrences known on the Lassen National Forest, one of which may be extirpated, and two occurrences are known to adjacent private lands. Potential habitat within the project area was surveyed but no occurrences of this species were located. Very little long-term monitoring has occurred for these species, but of the ten known occurrences found on or adjacent to the Lassen National Forest, one may be extirpated, and two others were not found when last visited (USDA Forest Service 2010). Most other occurrences are small (<200 plants) (USDA Forest Service 2010).

Desired Conditions

The Lassen Forest Plan management direction for sensitive plants includes the following goals (Forest Plan pp 4-26 and 4-27):

- Maintain habitat and viable populations to contribute to eventual de-listing of sensitive plants that are found on the Forest.
- Manage sensitive plants to insure that species do not become threatened or endangered because of Forest Service actions.

Environmental Consequences

Alternative 1 – No-action

Direct and Indirect Effects

There would be no direct effects to *Botrychium ascendens, B. crenulatum, B. minganense, B. montanum, B. pinnatum, Meesia triquetra, M. uliginosa, Oreostemma elatum* or *Silene occidentalis* ssp. *longistipitata* from the no-action alternative other than those associated with current ongoing activities.

Indirect effects of no action would be those associated with continued habitat succession, the current and future threat of noxious weed infestations and the threat of wildfire. Continued habitat succession within known occurrences would not affect most species within the project area. *Botrychium* spp. would not be affected because all *Botrychium* species are mycorrhizal and can be found in variety of timber types to open meadows (Laeger 2002). This is true also for the fen and wet meadow habitats where *Meesia* spp., *Oreostemma elatum* and at times *Botrychium* spp. can be found since trees, which may encroach into these areas over time are common and many times are required to sustain these systems. The no-action alternative may have negative impacts to potential habitat for *Silene occidentalis* ssp. *longistipitata* due to continued habitat succession, since this species typically grows in partially shaded conditions within mixed coniferous forests and is usually not found in areas with a dense canopy (USDA Forest Service 2007).

The threat of noxious weed invasion with the implementation of the no-action alternative is also not a concern, since the noxious weed risk assessment for the Creeks II project (planning record) determined that there was low current habitat vulnerability and a low to moderate risk from vectors not related to project implementation. In addition, since all treatable occurrences of noxious weeds within the project area would be treated regardless of the alternative chosen as part of the ongoing Lassen National Forest weed program, increased threat from noxious weeds with the implementation of the no-action alternative is not an issue.

Finally, it is impossible to determine where, when and how a wildfire may enter an area, thus analyzing the affects of wildfire to sensitive plant populations is unpredictable. Many times the impacts from fire suppression activities can have larger effects to sensitive plants and their habitat than the wildfire itself, and actual effects to sensitive species depends on fire timing and intensity. With the no-action alternative, stands would not be thinned. As a result, both ladder and surface fuels would continue to increase over time, leading to an increase in the risk of a high intensity wildfire (see discussion in the fuels section). Although *Botrychium* spp. appear able to survive a low to moderate intensity fire that does not kill mycorrhizal soil fungi, a high intensity fire could heat the soil enough to kill *Botrychium* plants and/or mycorrhizal fungi (Johnson-Groh and Farrar 1996). Due to the loss of stabilizing vegetation and duff, hydrological changes and increased erosion could also follow a high intensity fire. Such changes could destroy *Botrychium* spp. habitat, though this has not been documented.

While not much is known about fire effects on *Silene occidentalis* ssp. *longistipitata*, one occurrence is located within an old fire but plants were found only under residual trees, and it is not known how many plants existed prior to the fire and logging operations (USDA Forest Service 2010). Due to this species preference for partially shaded conditions, it can be assumed that a stand replacing fire would have the potential to negatively impact this species and its habitat. *Meesia* spp. and *Oreostemma elatum* plants and habitat are not likely to be affected by a high intensity fire because they occur in open, saturated, fen and wet meadow habitats that would most likely not burn in areas where these species are commonly found.

Cumulative Effects

A cumulative effect can result from the incremental impact of the action when added to the effects of past, present, and reasonably foreseeable future actions; however, under the no-action alternative there is no action in which to add. In the short-term under the no-action alternative, there are no direct or indirect effects to any sensitive plant species within the project area. The only potential indirect effects are due to continued habitat succession and the threat of a high intensity wildfire in *Silene occidentalis* ssp. *longistipitata* habitat. The threat of a high intensity wildfire can also have a potentially negative effect on *Botrychium* ssp. with the absence of thinning activities due to the implementation of the no-action alternative. However, the build-up of fuels and habitat succession are very long-term effects (20+ years), so cumulative effects are not a concern with the implementation of the no-action alternative.

Alternative 2

Direct and Indirect Effects

Direct effects involve physical damage to the plants or their habitat, such as crushing, breaking, or burning the plants; burying them under displaced slash or duff; or disturbing/compacting the soil. Such damage can kill the plants. With the implementation of the integrated design features for alternative 2, no direct effects to known occurrences of *Meesia triquetra*, *M. uliginosa*, *Botrychium minganense* or *B. montanum* are expected. All known occurrences would be flagged and avoided, and the fens and associated meadows where *Meesia triquetra, M. uliginosa* and *Botrychium minganense* species occur in would receive a 150 foot buffer as part of the Integrated design features for wet meadows (fens). In addition, all known occurrences of *Botrychium minganense* and *B. montanum* are found outside of proposed treatment units.

Since no known occurrences of *Oreostemma elatum* were found in the project area, and all potential fen habitat within the project area will receive a 150 foot buffer as part of Integrated design features for wet meadows (fens), there would be no direct effects to potential habitat to this or other fen species .

Potential habitat for all *Botrychium* spp. and *Silene occidentalis* ssp. *longistipitata* exists within the project area and may be impacted under the alternative 2 without detrimental effects to the viability of these species. While these species are being analyzed as having potential habitat within the project area, there is no definitive knowledge of why these species were not found during surveys, or were all potential habitats exists within the project area. Only general assumptions about habitat needs are discussed in regard to these species since not enough is understood about the specific habitat requirements for a detailed discussion of project level effects.

Although adequate botanical surveys have been performed in the project area, with the exception of *Botrychium montanum* and *B. minganense*, no other occurrences were found, but it is possible that isolated individuals of these and other *Botrychium* spp. may have been missed. Any undiscovered individuals have the potential to be impacted inadvertently most likely during RHCA and aspen enhancement treatments, since these species are found primarily within the inner zones in areas of permanently saturated soils.

Within the Creeks II project area there are approximately 2,878 acres of RHCAs found within the inner zones of seasonal and perennial streams. Alternative 2 proposes to treat approximately 274 acres within the inner zones throughout the project area under a variety of prescriptions (watershed and aquatic resources report, planning record). No other RHCAs will be impacted by project activities. As a result, approximately 10 percent of the potential *Botrychium* habitat could be directly impacted by project activities within the project area; however, with the implementation of integrated design features these areas should not be impacted by mechanical equipment, due to the requirement that soils be "dry" prior to implementation. In addition, while the above ground parts of *Botrychium* spp. are killed by fire, in the long-term these species are able to tolerate low to moderate intensity fires (Johnson-Groh and Farrar 1996). As a result, while there could be some short-term impacts to undiscovered occurrences and habitat for *Botrychium* spp. within the project, there should be no long-term detrimental affects to any of these species by the implementation of alternative 2. Additionally, if new occurrences are found before or during ground disturbing activities, they would be protected by flag and avoid methods as stated in the integrated design features for all action alternatives.

Potential habitat also exists within the project area for *Silene occidentalis* ssp. *longistipitata* in openings of mid-elevation mixed coniferous forests, often in rocky or sandy soils (USDA Forest Service 2007). Unlike *Botrychium* spp. though, potential habitat is most likely to occur in upland areas where DFPZ, area thinning and group selection treatments may occur. Impacts to any occurrences missed by surveys and potential habitat could occur in areas where mechanical equipment is used during timber harvest or post fuels treatment activities such as piling and prescribed fire. These impacts would be short-term and scattered across the project area, since this species was not located within the project area.

Indirect effects (either positive or negative) may impact these species by changing local hydrological patterns in sensitive plant habitat, the vegetation structure of the habitat, or can occur from the future threat of noxious weed invasion. There will be no indirect effects to *Meesia triquetra*, *M. uliginosa* or *Oreostemma elatum* since these species and their habitat are protected from indirect project activities by the integrated design feature of a 150 foot buffer for wet meadows (fens) within the project area. In addition, since fens tend to be saturated and nutrient poor, these systems do not seem to be suitable for noxious weeds, so the threat of future invasion is not a concern within fen habitats. Finally, the saturated nature of these habitats also prevents them from burning so there will be no impacts to these habitats from underburning activities.

Possible indirect effects to *Botrychium* spp. could occur if associated meadows, springs or streams were altered during project activities, causing changes to the hydrology of these areas. As with direct effects, impacts are most likely to occur within the inner zones of RHCA and aspen enhancement units, which are protected from direct disturbance by mechanical equipment due to the "dry" soil requirements. However, small seeps and springs missed during surveys could be impacted, and treatments in riparian areas even when soils are dry could alter hydrology on a small scale, especially with mechanical equipment. As a result, while there may be scattered impacts to unidentified *Botrychium* spp. occurrences and potential habitat by the implementation of alternative 2, these should not be detrimental to the viability of the species within the project area or throughout its range.

For the most part the change in vegetation structure will not affect sensitive plant species within the project area. Since *Botrychium* species are mycorrhizal, they can grow in a variety of habitats so the removal of trees and opening of the canopy should not be detrimental. *Silene occidentalis* ssp. *longistipitata* requires partially shaded conditions, so DFPZ construction and area thinning treatments, as well as edges created by group selection units would create habitat conditions preferred by this species and provide a potential long-term benefit after project implementation.

Another potential indirect effect is an increase in noxious weeds or other undesirable non-native species as a result of project activities. Thinning and burning create open microsite (and sometimes macrosite) habitats of reduced shade and soil cover, making conditions for noxious weed establishment favorable, and since these species are often more aggressive than the natives, they can quickly dominate a site. This risk is highest within group selection and aspen enhancement units where the canopy cover will be lowest and the ground disturbance highest after treatment activities. There are currently three California Department of Food and Agriculture listed noxious weed species known to occur in the Creeks II project area. Canada thistle is the most common species and occurs primarily within along Butt and Yellow creeks within the RHCA inner zones of aspen enhancement units. There are no known sensitive plant species within these areas; however, and integrated design features state that only hand treatment activities will occur within known Canada thistle occurrences so that the species is not spread throughout the project area. The noxious weed risk assessment (located in the planning record) completed for this project determined an overall low to moderate risk of potential weed spread with the implementation of the proposed action. In addition, the standard practice of equipment cleaning and integrated design features of avoiding or treating noxious weed infestations within the project area would reduce these potential effects.

Cumulative Effects

Context for effects analysis

Short-term timeframe: 1 year

Long-term timeframe: 20 years

Spatial boundary: Project area

Rationale: The project area was chosen as the cumulative effects analysis area for the remaining species because the historical range and specific habitat requirements are unknown for these species, and it is assumed that if the Creeks II project does not affect the viability of these species within the project area, then it would not affect their viability outside of the project area.

Past activities are considered part of the existing condition and are discussed within the affected environment section. This is because the existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed to those effects. All ongoing and foreseeable future actions found in appendix E were considered during the cumulative effects analysis for all sensitive species.

As stated previously a cumulative effect can result from the incremental impact of the action when added to the effects of past, present, and reasonably foreseeable future actions. With the implementation of the integrated design features, little or no direct or indirect effects are expected for the wet meadow/fen species *Meesia triquetra*, *M. uliginosa*, or *Oreostemma elatum*. Therefore, cumulative effects are not a concern for these species from the Creeks II project.

Ongoing and future actions will have similar effects to sensitive plants as the Creeks II project, since all projects have either been surveyed to similar standards as the Creeks II project or will be prior to project implementation. In addition, known sites of sensitive plant species will be flagged and avoided by project activities unless the project is intended to restore or enhance the species or its habitat or potential impacts are believed minor. Ongoing projects with the potential for the highest impact include vegetation management actions, special uses and trail maintenance activities, while other actions such as road maintenance, Christmas tree permits, woodcutting, and recreation activities by the public may be contributing only incidental effects on these species, if any (appendix E). Ongoing and future actions on private land as may also add cumulatively to sensitive plants impacts from the implementation of the Creeks II project, but since survey requirements and mitigations are not known on these lands, the type and extent of impacts to these species or their potential habitat cannot be quantified.

Ongoing range management activities could also have potential effects on all these species, and there is currently only one active allotment within the project area with a total 218 AUMs (Table 99). *Botrychium* spp. are susceptible to impacts by livestock especially along streams where plants growing along the banks can be damaged and their habitat destroyed by trampling. In addition, *Silene occidentalis* ssp.

longistipitata can be trampled and browsed by cattle, which could add cumulatively to impacts to their potential habitat caused from the implementation of alternative 2.

Ongoing, and future actions such as the Soda Underburn and the Grizzly Restoration Project will be surveyed to similar standards so that any impacts to sensitive plant species are either beneficial or mitigated so that the long-term viability of the sensitive species on the forest is maintained.

In conclusion, alternative 2 of the Creeks II project will treat approximately 8,060 acres through a variety of methods across the landscape. These actions, while avoiding impacts to all known occurrences of sensitive plant species, may affect potential habitat for *Botrychium ascendens, B. crenulatum, B. minganense, B. montanum, B. pinnatum* and *Silene occidentalis* ssp. *longistipitata* and these affects may add cumulatively to past, ongoing and future actions discussed within the project area. Any impacts to potential habitat within the project area should not be detrimental to the viability of these species within the project area.

Alternative 3

Direct and Indirect Effects

The main difference between alternative 3 and alternative 2 is that the project size was increased under alternative 3. To meet project objectives, this alternative proposes to treat an additional 264 acres of DFPZ, and approximately 68 acres less under area thinning. In addition, a new treatment M was developed to address concerns for furbearers within the project area. As a result, treatment activities within specific units may be different than those described under alternative 2. Alternative 3 also proposes to treat an additional 20 acres of group selection units within red fire to increase stand heterogeneity, while the acres for RHCAs and aspen enhancement treatments remain the same. As a result, direct and indirect effects will be similar for all sensitive plant species as those described under alternative 2 except there may be additional short-term impacts with potential long-term benefits to *Silene occidentalis* ssp. *longistipitata*, due to the increase in acres treated under the various DFPZ and area thinning treatments. There will be no additional impacts due to the increase number of group selection units because the majority of these new units were placed in red fire habitats, which is not considered potential habitat for this species.

Cumulative Effects

Cumulative effects for ongoing and foreseeable future actions for alternative 3 will be identical to those previously discussed within alternative 2. As a result, there will be no new impacts to these species when added cumulatively to past, ongoing, and future actions by the selection of alternative 3. Direct and indirect effects for all species will be similar to alternative 2, except there may be additional potential impacts to *Silene occidentalis* ssp. *longistipitata*, due to added DFPZ treatments under this alternative.

Alternative 4

Direct and Indirect Effects

Alternative 4 was designed to remove fuels only to the extent necessary to meet project objectives. As a result, multiple thinning treatments are proposed using the same treatment unit areas as alternative 3. The major differences between alternative 4 and the other action alternatives is that areas in which commercial thinning occurred between 1987 through 2005 have been excluded, and no group selection units or aspen treatments units are proposed under this alternative.

Direct and indirect effects from the implementation of alternative 4 will be similar to that of alternative 2 except there will be fewer impacts to potential habitat for *Botrychium ascendens, B. crenulatum, B.*

minganense, B. montanum, B. pinnatum, due to the removal of aspen enhancement treatments and the reduction in RHCA inner zone acres, which would eliminate impacts to potential habitat on approximately 81 acres within the project area. There would also be a decrease in potential effects to habitat for *Silene occidentalis* ssp. *longistipitata* under alternative 4 due to the elimination of group selection treatments and the decrease in treated acres for DPFZ and area thinning treatment.

Cumulative Effects

Cumulative effects for past, ongoing and foreseeable future actions for alternative 4 will be identical to those previously discussed within alternative 2. As with alternative 2, there will be no direct effects to known occurrences of sensitive species known to the project area, but there may be some effects to potential habitat for *Botrychium ascendens, B. crenulatum, B. minganense, B. montanum, B. pinnatum* or *Silene occidentalis* ssp. *longistipitata* from the implementation of alternative 4. These impacts and may add cumulatively to past, ongoing and future actions discussed within the project area. Impacts to potential habitat from the implementation of alternative 4 though should be smaller than those described within alternative 2, due to the decrease in acres treated under all treatments, but these impacts should not be detrimental to the viability of these species within the project area.

Sensitive Plants Determination

According to the botany biological evaluation for the Creeks II project (planning record) the following determinations have been made by the forest botanist:

With implementation of project integrated design features, including 150-foot buffers around all known fens, alternatives 2-4 will not affect *Meesia triquetra, Meesia uliginosa* or *Oreostemma elatum*, since no direct, indirect, or associated cumulative effects will occur.

Implementation of the Creeks II project alternatives 2-4, may affect individuals of *Botrychium ascendens, B. crenulatum, B. minganense, B. montanum, B. pinnatum*, or *Silene occidentalis* ssp. *longistipitata*, but is not likely to result in a trend toward Federal listing as threatened or endangered or loss of viability for these species.

Wildlife

Introduction

The project analysis for terrestrial wildlife considers the potential impacts to those species that are federally listed under the Endangered Species Act (ESA) as either threatened or endangered. The analysis also considers the potential effects to terrestrial animals that are identified by the Forest Service as being at risk due to limited habitat, limited populations, or both; collectively known as sensitive species. Forest plan direction for sensitive species is to manage habitat to ensure that Forest Service actions do not contribute to a sensitive species becoming federally listed. Additionally, the 1982 planning rules direct individual Forests to identify management indicator species (MIS) within their Forest Land and Resource Management Plans (Forest Plan). MIS were meant to represent a broad range of wildlife that inhabit national forest system lands with the belief that by analyzing a few species, the effects to a broad range of species could be known. Forest plan direction for the Lassen National Forest required that a project's potential impacts to individual MIS and their respective habitat be considered during the analysis process. Despite the criticism of using MIS as a proxy for other species (Niemi et al. 1997) the designation and analysis of MIS remains a requirement under the current planning direction that guides the analysis process for individual projects. In 2007, the Pacific Southwest Region (R5) issued the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (USDA Forest Service 2007a) for the Sierra Nevada Forests. Under this amendment, rather than analyzing for impacts to individual species, Forests are directed to consider impacts to MIS habitats. The results of the habitat analysis are then correlated to habitat and population trends over the bioregion (Sierra Nevada). While this approach was somewhat controversial, the courts have upheld this approach stating that the direction complies with the intent of the MIS direction under NFMA (Summary Judgment 8/2009).

This section summarizes the terrestrial wildlife including (federally) threatened, endangered and sensitive (TES) species; management indicator species (MIS); and migratory bird reports completed for this analysis. The terrestrial wildlife report considered federally listed species and wildlife considered to be “sensitive” by the Forest Service in Region 5 (California). Both federally listed and sensitive species have specific direction related to their management. The MIS report considers the effects to the habitat of MIS that are likely to occur within the project area. The migratory bird report considers the effect on birds listed as migratory birds by the USDI Fish and Wildlife Service that are likely to occur within the project area.

Management Direction and Laws

The project is consistent with all management direction concerning terrestrial wildlife resources.

The regulatory framework guiding this analysis is provided by the 1993 Lassen Forest Plan, as amended by the Herger-Feinstein Quincy Library Group Forest Recovery Act FEIS (1999), FSEIS (2003) and RODs (1999, 2003) and the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS (2001), FSEIS (2004) and ROD (2004). The project is also consistent with USDI Fish and Wildlife Service direction for threatened and endangered species and critical habitat.

Methodology

Methodology for analysis varies from one wildlife species to another, and each species is considered individually in the effects sections below and is covered more thoroughly in the wildlife report.

Overview of Issues

Current guidance, supported by recent research (USDA 2009), favors a more heterogeneous landscape. However, the implementation of projects that focus on increasing heterogeneity within landscapes dominated by dense mid-seral stands that are also home to focal species such as the California spotted owls or American marten is often controversial. In essence at issue is the question of whether the benefit of implementing certain actions designed, in part to increase or improve habitat for a broad range of plants and animals (increase diversity) outweighs the risk those actions have on select species. Secondarily, a balance between short-term risk for long-term gains (benefits) must also be considered.

Wildlife issues generally arise when attempting to strike a balance between meeting management objectives such as fuels or forest health and the desire to maintain or improve habitat for focal species, particularly those species associated with late seral habitats such as the California spotted owl and American marten. There is often the perception that vegetation management objectives and wildlife habitat objectives are mutually exclusive, however that is not always the case. Many, if not most terrestrial animals that are found in the Lassen National Forest, depend on habitat elements such as understory shrubs which are not commonly found in the dense forests that dominate most landscapes. The direction to retain large tracts of land for key species such as the northern goshawk or California spotted owl, can often have an adverse affect on a number of other terrestrial wildlife species such as migratory birds and species adapted to early seral or open habitats such as rabbits, deer, quail, and grouse. If the desire is to have a landscape with a healthy and diverse assemblage of terrestrial wildlife, then a heterogeneous landscape is essential.

Shrubs and herbaceous plants play an important part in providing quality habitat, especially in forest communities. Shrubs provide cover as well as food for a number of wildlife. However increases in stand density correlate with decreasing understory vegetation (North et al. 2005, Jameson 1967, Moore and Dieter 1992). In general, canopies over 40 percent, especially in fir forests, generally preclude understory vegetation, except for perhaps fir seedlings (Pase 1958, McConnell and Smith 1970, Moore and Dieter 1992). Shrubs are recognized as an important habitat component whether discussing late seral species such as the marten or spotted owl or early seral wildlife such as deer, quail, or rodents. Habitat exams across the project area have shown that many of the stands within the project area have, on average, less than 25 percent ground cover through shrubs and herbaceous plants; a condition not unexpected given the high canopy densities. Currently approximately 66 percent of the project area is in coniferous forest stands that are at or exceed 40 percent. In a number of stands shrub skeletons are present which serves to illustrate that shrubs, and likely forbs, did exist at one point. This decline in understory vegetation would indicate that habitat value, in terms of the value provided by shrubs and forbs, has also declined with the increase in canopy densities.

The density of a stand is important not only from a wildlife perspective but also in terms of the health of a stand and its susceptibility to fire. Stand density is typically measured in terms of the number of trees/unit of land such as a hectare or acre. Consideration should be given not only to the number of trees but also the amount of live biomass as measured through the basal area (the measure of the area of a cross section of the bole of all trees in a stand). This information can indicate how susceptible the stand is to disease and is more thoroughly discussed in the silviculture section.

Affected Environment

Existing Condition

Historical context

The landscape within the project area to which wildlife have adapted has changed considerably over the last 100 plus years. While the landscapes that existed before the turn of the century may not necessarily provide a paradigm for management, such information does provide clues on how landscapes were shaped by disturbances such as fire that occurred unfettered. The changes within the project area are a result of a number of factors. Fire suppression has been identified as a key reason for stands becoming denser as the loss of fire has allowed conifers, particularly fir, to increase in numbers. In addition to the preclusion of fire, management has also promoted unnaturally dense stands. Direction for management of forested stands generally focuses on maintaining stocking well above the average density that was found historically based on historical accounts, documents such as the report *An Ecosystem Management Strategy for the Sierran Mixed-Conifer Forests* (USDA Forest Service 2009), and the early survey data from the General Land Office (GLO) that was used in this analysis. Other management activities focused on converting shrub fields into plantations. This had the effect of not only increasing the amount of conifer cover but also reducing the natural heterogeneity of the landscape. Prior to the 1990s, timber harvest was primarily consisted of treatments such as shelterwood treatments that removed the older, larger trees and trees with disease or other imperfections in order to maximize the growth for lumber production. These treatments resulted in habitats that were generally sparsely covered by large trees with a cover of shrub and young (generally planted) conifers. Other treatments focused on removing the older trees from stands with a healthy young understory resulting in young, even aged stands.

Current Condition

Today, despite the numerous vegetation management activities that removed timber, the Creeks II project area, like many areas of the District, is dominated by dense stands, dominated by fir. Stands that would be considered mature (late seral) or early seral are clearly in the minority. The silviculture section outlines the current vegetative composition within the analysis area.

Table 50. Existing condition for average snag, log, and herbaceous cover

	Average Number Snags/Acre (≤15"d.b.h.)	Average Number Logs/Acre (Min Size 12" X 8')	Average % Ground Cover within Stands (Shrubs and Herbaceous)
Existing Condition	7	11	7.5%

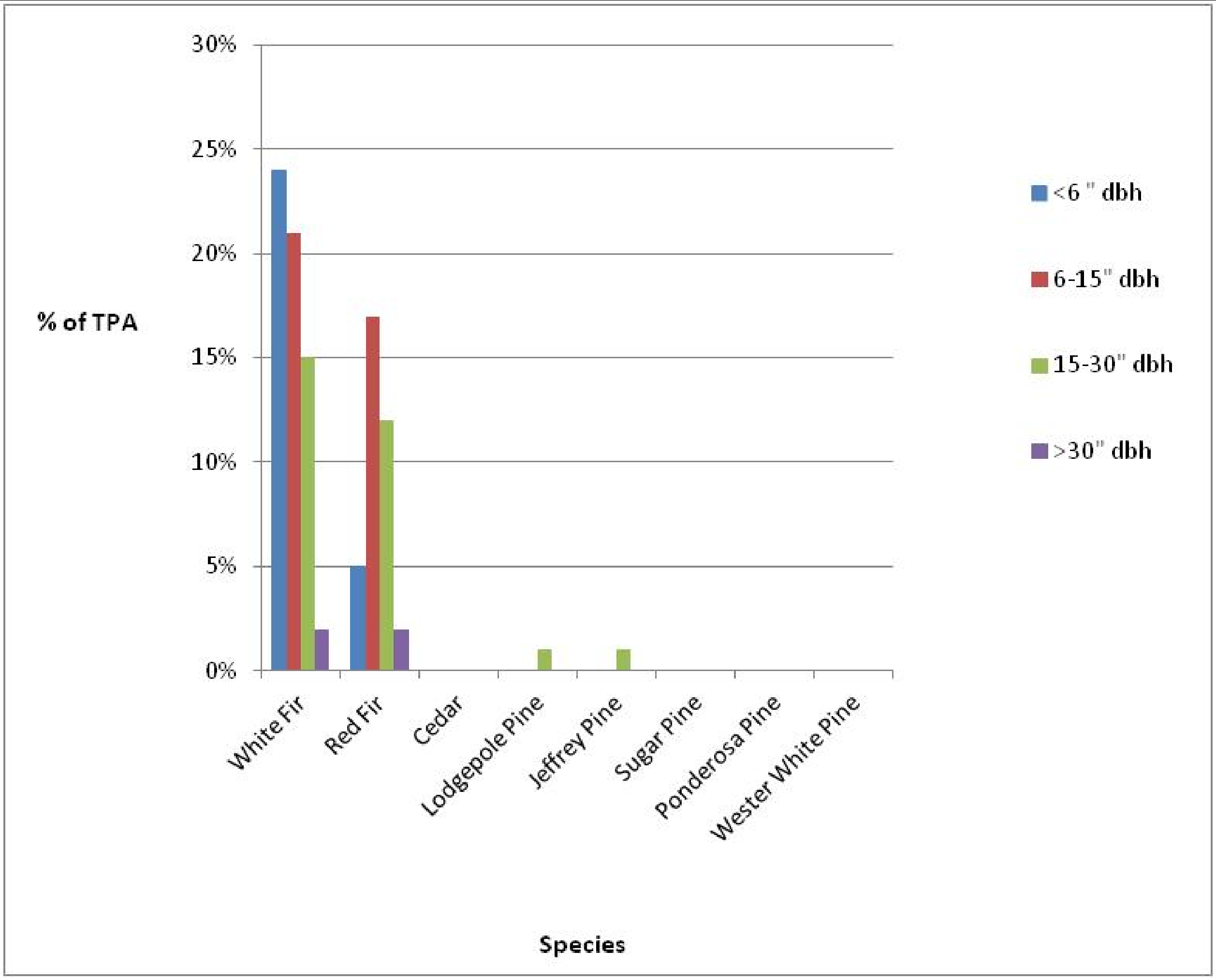


Figure 19. Trees per acre by size class: Creeks II project area

The silviculture report provides an overall description of the various vegetative communities and discusses the species diversity that exists within the stands. However the silvicultural section does not provide a description of important habitat attributes such as understory vegetation, or snags. Current direction is to retain 4 – 6 snags/acre where snags are dead or dying trees greater than 15 inches d.b.h. While decay rates differ by species, snags from the most common species available generally have a half life of less than 10 years (Landrum et al. 2002). The life of a snag also depends on the size as generally, the larger the tree, the longer the snag will last. Since, in many cases, the large trees have been removed, snag development is increasingly dependent on the smaller size classes, thus retaining a certain number of snags on a landscape is dependent on fairly regular recruitment. Snag recruitment typically depends on episodic events such as drought, fire, disease or a combination of factors. While these processes provide snag habitat, they can also result in declines in important habitat elements such as large, live, trees.

Table 50 summarizes the results of habitat surveys conducted within the project area in 2010. The data includes the average number of snags per acre and the percent understory vegetation (shrubs and forbs). Small trees make up the greatest percentage of conifers for all species, particularly the true firs. If plotted by size, under the current conditions the trees would form an “inverse J” as illustrated in figure 10, where the majority of trees are small with a decreasing number of trees in the upper size classes. This is in stark contrast to the historical conditions found within the GLO data in most areas of the District and with that displayed by North et al. in GTR-220 (USDA Forest Service 2009).

Environmental Consequences

Threatened, Endangered and Sensitive Species

This group consists of species listed under the Endangered Species Act (ESA) as either threatened or endangered (TE) and species listed as sensitive (S) by the Regional Forester, Pacific Southwest Region. The USDI Fish and Wildlife Service provided a list of terrestrial threatened and endangered species that have the potential to occur on the Lassen National Forest (USDI Fish and Wildlife Service 2010). These species along with the sensitive species designated by the Regional Forester for the Lassen National Forest are listed in Table 51. The column on the right-hand side of the table indicates their potential presence within the project area and whether they are considered in the analysis of effects.

Based on the information summarized in Table 51, there are no federally listed species that are likely to be impacted by this project. The sensitive species that may occur within the project area include the California spotted owl, northern goshawk, American marten, willow flycatcher, and the Pacific fisher. Although the fisher has been notably absent from the forest since at least the 1940s (Ingles 1947), the recent release of fisher on private lands near the project area requires that the analysis consider this forest carnivore.

California Spotted Owl

Species Status

There are four demographic study areas located throughout the range of the California spotted owl which include the Lassen, Eldorado, and Sierra National Forests and the Sequoia and Kings Canyon national parks. The most recent analysis of the owl populations within these study areas (Blakesely et al. 2006, Blakesely et al. 2010) found that, with the exception of the Lassen study area, overall owl populations were stable. The analysis indicated an annual decline in the Lassen study population of 2 – 3 percent between 1990 and 2005. The report stated that, given the findings, caution was warranted when planning vegetation management activities that might affect owl habitat. Recent analysis has determined that the rate of decline is less steep but still remains near 2 percent annually (Keane, personal communication). The project area has continued to be surveyed annually under the Lassen Spotted Owl Demography Study.

Table 51. Threatened, endangered, and sensitive species potentially occurring on the Lassen National Forest

Species	Status	Species or Habitat Present	Consideration
Thamnophis gigas - giant garter snake	FT	No	***Not Considered***. This species resides in the central valley and is not known to occur on the Forest.
Strix occidentalis caurina; Northern Spotted Owl	FT	No	***Not Considered***. The species is not known to occur on the Almanor Ranger District. The project area is outside the range of this species.
Desmocerus californicus dimorphus; Valley Elderberry Longhorn Beetle	FT	No	***Not Considered***. Suitable habitat is found below 3,000 feet (Project elevation is above 5,500 feet).
Haliaeetus leucocephalus Northern Bald Eagle	FSS	No	***Not Considered*** The project area lacks the lakes and large rivers preferred by this species.
Strix occidentalis occidentalis; California Spotted Owl	FSS	Yes	***Considered***. The project area has suitable habitat and active territories.
Accipter gentilis; Northern Goshawk	FSS	Yes	***Considered***. The project area has suitable habitat and active territories.
Strix nebulosa; Great Gray Owl	FSS	No	***Not Considered***. The areas affected by the project lack meadow habitat large enough to meet the needs of this species.
Grus Canadensis tabida; Greater Sandhill Crane	FSS	No	***Not Considered***. The project area lacks the large open meadows preferred by this species.
Buteo swainsoni; Swainson's Hawk	FSS	No	***Not Considered***. The project area is outside the known range of this species.
Empidonax trailii; Willow Flycatcher	FSS	Yes	***Considered***. There is limited habitat for this species and there is an occupied site within the project area.
Martes Americana; American Marten	FSS	Yes	***Considered***. The species has been detected within the project area.
Gulo gulo luteus; California Wolverine	FSS	No	***Not Considered***. This species has not been detected within the Forest in over a decade.
Vulpes vulpes necator; Sierra Nevada Red Fox	FSS	No	***Not Considered***. This species is not known to occur south of Highway 36, well outside the project area.
Martes pennanti; Pacific Fisher	FSS/C	No	***Considered***. The only detections of this species have been the experimental population released on private lands. Potential impacts are considered.
Antrozous pallidus; Pallid Bat	FSS	No	***Not Considered***. The project area is outside the recognized range for this species and lacks the open habitats preferred by pallid bats.
Corynorhinus townsendii; Townsend's Big-eared Bat	FSS	No	***Not Considered***. The project area lacks the maternity roost structures (caves, bridges) required by this species.
Lasiurus blossevillii; Western Red Bat	FSS	No	***Not Considered***. The project area lacks the large rivers, lakes, and reservoirs that this species has been associated with on this forest and is well above the elevational range of this bat.
Clemmys marmorata marmorata; Northwestern Pond Turtle	FSS	No	***Not Considered***. Surveys have shown that populations are limited to the lower portions of Deer, Antelope and Mill Creeks.

FT Federally listed as Threatened
C Candidate for Federal Listing
FSS Forest Service sensitive

The project area is dominated by suitable habitat but the vast majority would be defined as moderate habitat quality (CWHR 4M, 4D) for spotted owls with only about 5 percent of the project area composed of high quality habitat (defined as CWHR 5M, 5D, and 6). Several studies have demonstrated that owls prefer to have nest or roost sites that are in stands dominated by mid to late seral habitat (Keane 2006, Blakesley 2005). The owl module of the HFQLG Administrative Study (Keane 2009) has looked at a number of nest locations and found that while owls preferred stands dominated by large trees (defined as trees 24 inch d.b.h. and larger), owl nests were also found in what would be considered moderate habitat value. One factor that appears to influence the use of stands where the average tree size is between 12 and 24 inches d.b.h. (moderate value habitat) for nesting; is the presence of large trees, even if only a few are present. Clearly nesting opportunities are enhanced with the presence of these large trees that provide the structure conducive to building nests whether hollows in trees or stick nests on branches. Table 52 displays the overall percentage of the project area composed of suitable habitat, providing a comparison of how much moderate habitat has a large tree component within the individual stands.

Table 52. California spotted owl habitat summary

CWHR	Acres (%) of Habitat without Large Tree Component On NFS Lands in Project Area	Acres (%) of Habitat with Large Tree Component on NFS Lands in Project Area	Total Acres (%) of habitat on NFS Lands in Project Area
4D	1,242 (4%)	3,499 (12%)	4,741 (16%)
4M	6,262 (21%)	6,092 (21%)	12,354 (42%)
5D	0%	0%	0%
5M	0%	1,373 (4%)	1,373 (4%)
6	0%	122(<1%)	122(<1%)

Table 53 provides the residence status of the various territories within or overlapping the project area that have been identified over the last decade. One factor that may be influencing occupancy is elevation. Many of the unoccupied or rarely occupied territories such as Eagle Rocks and Shanghai Creek are centered in areas that average at or above 6,000 feet, the elevation where owl occupancy declines on the District.

Table 53. Summary of California spotted owl territory occupancy

Territory	Years Occupied 1999-2009	Year Last Occupied	Number of Successful Nests 1999 - 2009
Blue Lead Gulch	1	1999	0
Butt Creek	9	2009	2
Eagle Rocks	0	1991	0
Fanani Meadows	5	2009	3
Fanani South	10	2009	6
Grizzly Creek	4	2002	1
Little Grizzly	5	2004	1
Miller Ravine	5	2009	1
Peacock Point North	2	2009	0
Peacock Point SOHA	1	1999	0
Robbers Roost	1	1999	0
Ruffa Ranch	2	2001	1
Shanghai Creek	1	2009	0
Shanghai North	11	2009	6
Slate Creek	0	1997	0
Upper Yellow Creek	9	2009	2

Reproduction within the project area varies and annual nesting success appears to be principally affected by annual precipitation (Keane 2010, North 2000, and Franklin et al. 2000). Prolonged winter storms often extend into June which often results nest failures. Keane (2007) illustrated how precipitation can affect nesting success after looking at nesting success over three seasons (2004 – 2006) during years experiencing widely differing annual precipitation.

Although owl territories often vary in the amount of habitat, certain characteristics are generally recognized as needed to provide suitable habitat. Table 54 summarizes a description of habitat results from a number of studies of owl habitat (USDA 2000).

Table 54. Summary of habitat suitability attributes

Stand Attributes	Nesting/Roosting Habitat	Foraging Habitat
	Range of Attributes	Range of Attributes
Percent Canopy Cover (>30’ high, including hardwoods)	70 – 95	40 - 90
Total Live Tree Basal Area (BA) (>15” d.b.h. – BA^2/Acre)	185 – 350	180 – 220
Total Snag Basal Area (BA^2/Acre >15” d.b.h. and >15’ in Height)	30 – 55	15 – 30
Basal Area of Large Snags (Square feet/Acre)	20 – 30	7 – 17
Down Woody Debris (Tons per Acre)	10 – 15	10 - 15

Keane (2006) sampled 80 nest sites using Forest Inventory and Analysis plot methods (Table 55). The plot data provided a slightly different set of variables to describe nest site habitat as compared to those outlined in Table 54 but the elements are very similar.

Table 55. Habitat suitability attributes: Keane 2006

Variable	Mean	SD
Total Basal Area (ft^2/ac)	260.8	57.9
Trees >30 inches (#/acre)	10.7	5.2
Snags >15 inches (#/acre)	7.4	7.2
Litter (tons/acre)	23.7	16.2

Blakesley (2003, 2006) had findings similar to Keane’s in terms of nest stand characteristics. Both recognize the importance of a large tree component within stands to enhance nesting habitat. Blakesley (2003) found that 83 percent of 500 acres surrounding the nest site was composed of forested stands dominated by trees ≥30 cm d.b.h. (CWHR size class 4 or larger) with ≥40 percent canopy cover. Keane (2006) found an average of approximately 76 percent suitable habitat around the 500 acre nest site. The difference between the Keane and Blakesley data is primarily due to the different vegetative layers that were used for each analysis. When reviewing the same landscape, the vegetation layer used by Blakesley contained greater amounts of suitable habitat, and a greater percentage of habitat classified as “mature” (CWHR 5M, 5D, and 6) then does the vegetation layer used by Keane and this analysis. For consistency with local research the vegetation layer used in this analysis is the same as that used by Keane.

Summary of Effects to California Spotted Owl

The effects analysis for the California spotted owl considered the changes to the territory at two levels in keeping with the body of research on spotted owls within the region. The 500-acre area immediately surrounding the nest and roost site, termed the inner zone, was considered for the potential effect to nesting and reproductive efforts at known occupied sites. The larger area, the outer zone, is a 1,000 acre area surrounding the nest or roost site, and shown in Figure 20 and Figure 21, is commensurate with a number of studies that have looked at the effects of vegetation management on owl survival and reproduction.

Figure 20 outlines the protected activity centers (identified by name) and the owl territories that have been identified within and adjacent to the project area. The buffer outlines the area considered in cumulative effects. Identifying the territories early in the planning process provided a means to develop treatments that met project objectives but limited potential adverse effects to spotted owls. However the development of alternatives stretched beyond 2008 therefore, due to minor shifts in the 2009 territory locations, a revised territory location was used to determine if changes were needed in project design to meet the overall objectives. A review of the treatments considered in the alternatives comparing both the 2008 and 2009 territory locations outlined in Figure 21 indicated that the 2008 territory locations provided the greatest risk to the spotted owl with respect to the alternatives being proposed; therefore the 2008 territory locations were used for the overall analysis.

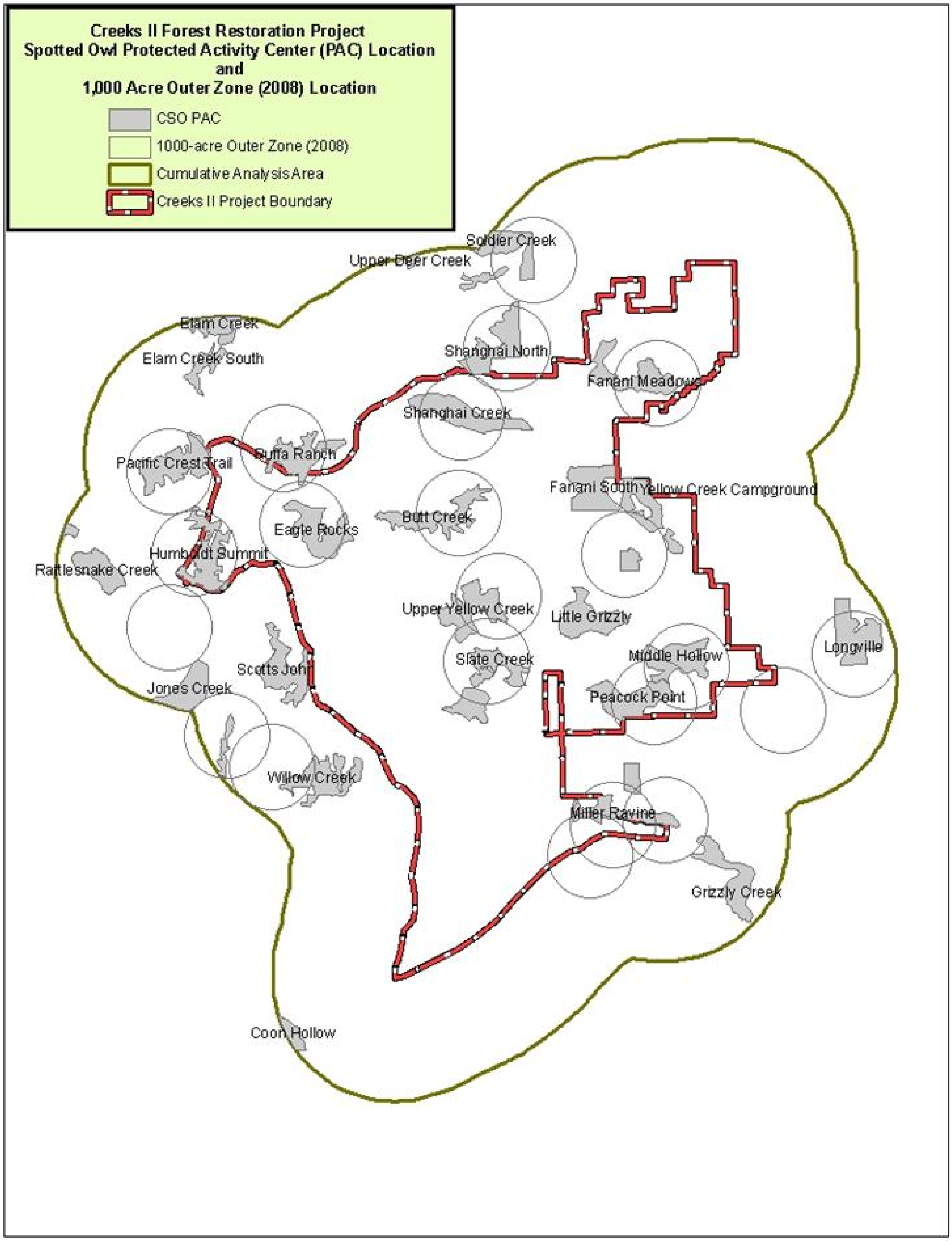


Figure 20. California spotted owl 2008 territory and protected activity center locations

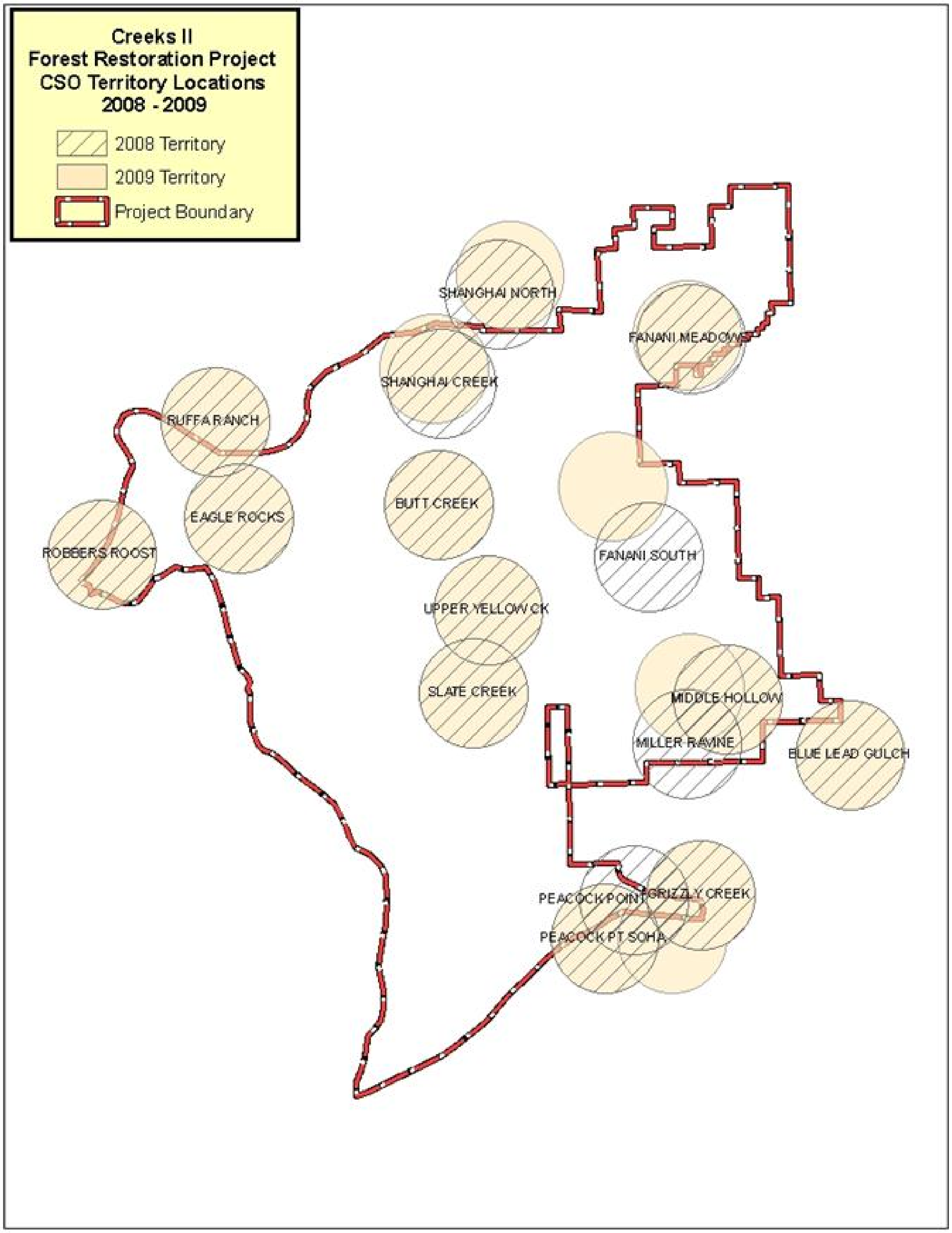


Figure 21. 1000 acre territory locations: 2008 and 2009

Table 56 and Table 57 provide a comparison of habitat for those territories in Figure 21 for the years 2008 and 2009.

Table 56. Habitat summary associated with territory location 2008 - 2009; inner zone

Territory	% Unsuitable		% Moderate		% High	
	08	09	08	09	08	09
Blue Lead Gulch	59%	59%	41%	41%		
Butt Creek	22%	24%	67%	76%	9%	
Eagle Rocks	48%	48%	52%	52%		
Fanani Meadows	**31%**	**27%**	**59%**	**61%**	**11%**	**12%**
Fanani South	**25%**	**25%**	**77%**	**71%**		**4%**
Grizzly Creek	42%	42%	58%	58%		
Middle Hollow	5%	5%	95%	95%		
Slate Creek	50%	50%	49%	49%	1%	1%
Miller Ravine	**3%**	**15%**	**97%**	**85%**		**0%**
Peacock Pt	**28%**	**17%**	**71%**	**57%**		**26%**
Peacock Pt SOHA	10%	10%	63%	63%	27%	27%
Robbers Roost	94%	94%	5%	5%	2%	2%
Ruffa Ranch	40%	40%	22%	22%	39%	39%
Shanghai Creek	**14%**	**13%**	**39%**	**53%**	**47%**	**34%**
Shanghai North	**37%**	**42%**	**25%**	**18%**	**38%**	**40%**
Upper Yellow Ck	40%	40%	60%	60%		

Bold territories indicate location change from 2008 to 2009.

Table 57. Habitat summary associated with territory location 2008 - 2009: outer zone

Territory	% Unsuitable		% Moderate		% High	
	08	09	08	09	08	09
Blue Lead Gulch	54%	54%	45%	45%	1%	1%
Butt Creek	37%	37%	58%	58%	4%	4%
Eagle Rocks	53%	53%	45%	45%	2%	2%
Fanani Meadows	**40%**	**18%**	**51%**	**55%**	**9%**	**12%**
Fanani South	**40%**	**27%**	**60%**	**67%**	**0%**	**6%**
Grizzly Creek	52%	52%	48%	48%		
Middle Hollow	12%	12%	87%	87%	0%	0%
Slate Creek	51%	51%	47%	47%	2%	2%
Miller Ravine	**12%**	**14%**	**88%**	**85%**		
Peacock Pt	**31%**	**19%**	**65%**	**50%**	**3%**	**31%**
Peacock Pt SOHA	25%	25%	48%	48%	27%	27%
Robbers Roost	76%	76%	20%	20%	5%	5%
Ruffa Ranch	49%	49%	24%	24%	28%	28%
Shanghai Creek	**18%**	**16%**	**48%**	**52%**	**34%**	**32%**
Shanghai North	**35%**	**44%**	**39%**	**33%**	**26%**	**23%**
Upper Yellow Ck	35%	35%	65%	65%		

Bold territories indicate location change from 2008 to 2009.

Direct and Indirect Effects

Currently, wildfire is seen as one of the greatest risks to owl habitat. However, the risk to trees from disease brought on by dense stands and declining available soil moisture must also be considered. Alternative 1 (no-action) would maintain the current conditions and trends toward increasing stand density which may benefit the owl initially, however there would be a corresponding increase in the risk to habitat from both fire and disease due to various causal agents including drought-related mortality. In particular, this puts the large tree component, an essential part of nesting habitat, at risk. The analysis assumes that trends towards a greater amount of nesting habitat would also benefit the amount and quality of foraging habitat. The large tree component would likely be slow to develop as the impact of competition of resources that conifers are subject to in dense stands would slow both radial growth and crown diameter expansion. Should drought related mortality become prevalent, not only would current occupied habitat be affected but also habitat that could serve as “replacement” habitat within or adjacent to the project area may also be affected.

Alternatives 2 and 3 are very similar and therefore so are the anticipated effects. As shown in Table 58 and Table 59 the amount of treatment and effects to suitable habitat are essentially the same in both alternatives. Although disturbance during implementation is a potential, the risk to nesting owls is limited with the implementation of limited operating periods (LOP) as prescribed through current direction. Treatment A would reduce currently suitable habitat to low suitability. This would pose a low risk to the California spotted owl as little of treatment A falls within occupied territories and approximately 50 percent of treatment A is currently unsuitable or only marginally suitable. The remaining treatments either do not affect suitable habitat (such as treatment D) or are designed to retain key attributes while reducing the risk of widespread mortality due to wildfire as well as the increased risk of insect and disease that can result from dense stand conditions. As part of the project design, the placement of group selections within the owl territories was very limited and included only where sufficient habitat already exists. As most groups were in placed in young dense stands, group selections would have a very limited impact on habitat and would not be expected to affect the status of owls within the project area. Both alternatives 2 and 3 are likely to result in long-term benefits.

Table 58. Alternative 2 summary of treatments within California spotted owl territories

Territory	Inner Zone		Outer Zone	
	% of Zone Treated	% of Suitable Habitat Treated	% of Zone Treated	% of Suitable Habitat Treated
Blue Lead Gulch			3	6
Butt Creek	13	11	20	19
Eagle Rocks	3	0	4	0
Fanani Meadows	10	2	14	10
Fanani South	5	5	9	10
Grizzly Creek	3	0	3	0
Middle Hollow	1	1	19	11
Miller Ravine	8	31	4	3
Peacock Pt.	11	0	8	0
Peacock Pt. SOHA	0	0	4	0
Robbers Roost	0	0	2	0
Ruffa Ranch	2	4	5	7
Shanghai Creek	12	12	13	12
Slate Creek	34	13	33	18
Upper Yellow Creek	8	6	14	13

Based on the silvicultural report, the objective of increasing the potential large tree component would be enhanced through the thinning under either alternative 2 or 3. As noted, large trees are a key component need to develop nesting habitat and is lacking or only marginally present in many stands (Table 52). Alternative 3 includes treatment M with a corresponding reduction in the acres of treatment A. Treatment M would retain habitat suitability however most of this treatment is within the red fir zone, an area with low detections of spotted owls presumably due to the higher elevation.

Table 59. Alternative 3 treatment summary within California spotted owl territories

Territory	% of Inner Zone Treated	% of Outer Zone Treated
Blue Lead Gulch	0	3
Butt Creek	13	19
Eagle Rocks	3	5
Fanani Meadows	10	14
Fanani South	4	9
Grizzly Creek	5	3
Middle Hollow	1	19
Miller Ravine	8	8
Peacock Pt. North	11	8
Peacock Pt. SOHA	0	4
Robbers Roost	0	2
Ruffa Ranch	2	5
Shanghai Creek	12	13
Slate Creek	34	33
Upper Yellow Creek	8	14

The treatments in both alternative 2 and 3 were designed to minimize impacts to California spotted owl and their habitat. By design, those territories that have not had territorial owl activity in recent years (generally in over a decade) include more acres of treatment than those where there has been recent activity. Where there is treatment within recently occupied territories, the emphasis is on treating unsuitable or low quality habitat to attain increases in the amount of quality suitable habitat in the future. Also habitats that lack a large tree component were emphasized for treatment to increase the amount of nest and roost habitat in the future. The treatments of either alternative would result in very little habitat loss within any territory however they would provide long-term benefits including a reduction in the risk of habitat loss due to fire and the increased risk of mortality due to insect and disease. The existing large tree component would also benefit from a reduce risk of mortality and treated stands are likely to attain larger trees sooner as tree growth responds to a reduction in resource (sunlight and water) competition.

Both alternative 2 and 3 utilize the same road system and include the same road proposals. These would have limited effect on the overall amount of suitable habitat and do not reduce the overall value of habitat within existing territories.

The follow-up treatments, which include two types of machine treatment (tractor and grapple), and underburning is likely to result a further loss of conifers (through mortality of smaller trees during broadcast burns) but is also likely to stimulate understory vegetation (shrubs and herbaceous plants) where canopies are more open (less than 40 percent canopy). The treatment design for both alternative 2 and 3 the retention of healthy smaller trees (defined as having a 50 percent live crown) as a means to retain a multi-aged stand. Underburning may remove some of the smaller trees and reduce the benefit of retaining smaller trees. Underburning may also affect portions of the leave islands left in several of the treatments, resulting in a slight increase in the number of small snags. The mastication proposed would only occur in plantations that have low or very low suitability. The conifer mortality may also help to increase stand diversity which would be expected to benefit the owl through increases in prey numbers.

Table 60. Acres of treatment within the 500 acre inner zone, alternative 4

Territory	Treatments					Total	% of Suitable Habitat Treated
	1	2	3	4	5		
Butt Creek		8		56		64	11
Fanani Meadows	42			8		50	2
Fanani South				30		30	0
Grizzly Creek	13					13	1
Middle Hollow		3				3	1
Slate Creek	21	52	3	86	8	170	17
Miller Ravine		3		12	11	26	1
Peacock Pt.	52			4		56	0
Peacock Pt. SOHA						0	0
Ruffa Ranch		12				12	4
Shanghai Creek				41	1	42	9
Upper Yellow Creek				41		41	0

Table 61. Acres of treatment within the 1000 acre outer zone, alternative 4

Territory	Treatments					Total	% of Suitable Habitat Treated
	1	2	3	4	5		
Blue Lead Gulch				26	1	27	6
Butt Creek		71		119		190	19
Fanani Meadows	46	29		49		125	11
Fanani South				102	3	105	13
Grizzly Creek	28					28	0
Middle Hollow	36	74		27	23	159	9
Miller Ravine		13		24	19	56	2
Peacock Pt.	57	9		19		84	0
Peacock Pt. SOHA	27	11				38	0
Slate Creek	54	101	10	149	19	333	22
Ruffa Ranch	15	28				43	7
Shanghai Creek	24			83	2	109	10
Upper Yellow Creek				124		124	10

The design of alternative 4 (Table 60 and Table 61) is very similar to past treatments in that the actions included removing vegetation up to a given size (upper diameter limit) of the conifers within the stand. In general the canopy within stands treated in this alternative would be between 30 percent and 40 percent post treatment. The treatments would reduce the heterogeneous nature of the treated stands. Treatment 5 would retain at least 40 percent canopy where it is applied (within the inner zones of RHCAs) and although habitat quality would be reduced, currently suitable habitat would generally remain suitable. While there is some variation on the upper diameter limit of the various treatments, the treatments would reduce the suitability either through a reduction of cover, through the loss of structural diversity, or both. Alternative 4 provides essentially the same risk to habitat as treatment A (alternatives 2 and 3). Although alternative 4 has lower upper diameter limits, the silvicultural modeling indicates that within California spotted owl habitat over 95 percent of the trees removed under treatment A would be less than 14 inch diameter and approximately 92 percent would be under 10 inch d.b.h. Therefore the results from treatments 1 – 4 in alternative 4 would be similar to treatment A regardless of the upper diameter limit, Overall, the alternative would have a minor impact on any of the currently occupied territories as the alternative generally affects a minor portion (generally less than 10 percent) of the inner and outer zones. As with alternatives 2 and 3, the Slate Creek territory is most affected by that territory has a very limited history of occupancy over the last decade and therefore the direct risk to owls is low. Because the treatments in alternative 4 were not designed to maintain habitat within owl territories, the alternative results in a reduction of overall habitat without providing long-term benefits with the exception of reducing the threat of intense wildfire.

Overall, with few exceptions alternative 4 would generally impact 10 percent or less of either the inner or outer zone of the owl territories. The majority (60 percent) of the treatments occur in treatments 4 and 5 which would generally meet minimal cover requirements although other structural elements such as stand heterogeneity would be reduced. The remainder of the activities fall within treatments 1 – 3 which would render the treated habitat unsuitable. The right hand column indicates the percent of suitable habitat that would be changed to unsuitable or only marginally suitable. Those territories that have the most treatment are those with the poorer occupancy records and therefore treatment pose less risk to the owl. There are, however, several key exceptions. Despite a good occupancy and reproductive record, Fanani South is already limited in the amount of suitable habitat and further losses without a benefit to the habitat would lead to a downward trend in short and long-term habitat quality for that territory. Both the Shanghai and Slate Creek territories have poor occupancy records and, at least in the case of Slate Creek, habitat quality may be one of the factors that limit occupancy. The loss of suitable habitat, with no expectation that habitat value would improve over time, would also lead to a downward trend in habitat for both territories, potentially leading to a decline in reproductive territories.

Opening up the stands would have a positive effect on habitat for predators such as the great horned owl and goshawk and could provide additional risk to the spotted owl.

The post treatment activities such as piling and burning are unlikely to produce any additional measurable effects. Underburning typically leads to limited mortality but is often useful in snag recruitment although usually within the smaller class sizes. There would be some gains in understory vegetation, although this would likely occur in those stands that become unsuitable, limiting any immediate benefit to the owl.

Cumulative Effects

The cumulative effects area of consideration encompasses the project area and those occupied territories adjacent to the project area (Figure 20). This area includes all territories that could be both directly or indirectly affected by the project and the associated activities.

The habitat conditions found within the project area are a result of a number of factors including fire suppression, climatic conditions, and past management activities that favored the removal of larger trees and, later, retention of denser habitat. Alternative 1 would continue stand trends towards a landscape dominated by dense, mid-seral habitat (small to medium sized trees) with decreasing heterogeneity. Private lands within the project area, particularly private timberlands, are generally trending towards early seral due to natural conditions (open meadow) or harvest activities that affect approximately 10 percent of the private lands annually. In terms of the impacts at a landscape level, if all suitable habitat on private lands (approximately 1,760 acres) were made unsuitable, alternative 3 would contribute the least to cumulative effects. Table 62 reviews the overall cumulative effects from actions under each of the action alternatives when combined with loss of suitable habitat on private lands. Table 62 presents a “worst case” scenario. The risk of these cumulative losses are not likely to occur as Table 62 does not consider the additional suitable habitat that will be gained from younger stands attaining suitable habitat attributes. Also private lands are not being made unsuitable at a rate that would be likely to result in the cumulative losses expressed in Table 62.

Table 62. Percent change in the amount of suitable habitat; cumulative loss of habitat

Alt 2 Acres of Cumulative Loss of Alternative and Private Lands	% Change to current Amount	Alt 3 Acres of Cumulative Loss of Alternative and Private Lands	% Change to current Amount.	Alt 4 Acres of Cumulative Loss of Alternative and Private Lands	% Change to current Amount.
2085	19	1105	14	3501	26

In terms of individual territories, private lands generally make up a small portion of most territories except for Fanani South and Blue Lead Gulch. Treatments in Fanani South included only those prescriptions (within suitable habitat) that would improve habitat conditions with little effect to habitat suitability. Blue Lead Gulch has limited activities proposed under any of the alternatives and project activities would affect little of the suitable habitat on federal lands. Therefore, overall loss of all habitat on private lands would have little cumulative effect with actions in alternatives 2 or 3 with respect to individual territories.

While there are fewer acres of treatment within the individual territories under alternative 4, all treatments, with the exception of treatment 5, are likely to reduce habitat suitability to a marginally suitable or unsuitable condition. Therefore, the overall effect can be greater. This would combine with actions on private lands to further reduce the amount of suitable habitat within the individual territories. As shown in Table 62, this alternative provides the greatest cumulative effect at the landscape level and this would also be true of the effects to individual territories.

Northern Goshawk

Species Status

In North America, the goshawk ranges from Alaska and Canada and through the western US (Peterson 1961). Within California, the goshawk occupies a variety of habitats and is generally recognized as being a habitat generalist in that successful home ranges generally include a wide range of habitat types with the exception of nest habitat. Nests are typically built in stands that have dense overstory and a relatively open understory. Most nests are well hidden and often difficult to see as they are typically concealed by heavy branches or mistletoe brooms.

As with the spotted owl, the northern goshawk has long been considered a species of concern. In 1998 the USDI Fish and Wildlife Service reviewed the status of the northern goshawk (west of the 100th meridian) and determined that federal listing was unwarranted (Smith et al. 2005). The USDI Fish and Wildlife Service found that there was no evidence of population declines and that the change in direction on federal lands towards managing for fuels rather than primarily for commodities reduced the overall risk to the goshawk. Today, the Forest Service considers this a sensitive species.

Goshawks territories generally consist of 3 – 9 nest sites, many of which are considered alternate nests that may not be reused (Woodbridge and Deitrich 1994). Reynolds et al. (1992) described goshawk territories as consisting of a nest area, a post-fledgling area that surrounds the nest, and a larger foraging area. A typical post-fledging area is approximately 170 hectare (approximately 420 acres) in size and a mosaic of large trees, large snags, mid-aged forests, small openings with an herbaceous understory, and large, downed logs (Graham et al. 1994). A vegetation mosaic is important as goshawks prey on a wide number of species of both birds and mammals.

From their work, Reynolds et al. (1992) developed models for goshawks in the southwest that represent a desired condition for goshawk post-fledging areas (Table 63). This model shows that while dense habitat is ideal, 20 percent of the ideal post-fledgling area consists of more open areas. These areas would provide different prey species than those found in the denser forested habitats.

Table 63. Goshawk post-fledging area (PFA) management recommendations Reynolds et al. 1992

CWHR Size Class	Total % of PFA	Minimum Canopy Density
6	20	>60%
5	20	>60%
4	20	>60%
3	20	all
2	10	all
1	10	all

The model is based on the assumption that habitat selection is driven by both the need for hiding cover and to enhance prey availability (Reynolds et al. 1992). This is not a universally accepted rationale. Beier and Drennan (1997) argued that their study indicated that forest structure is more important than prey abundance. However, they also say that managing toward such models would improve foraging habitat through retention of the larger trees and an increase in diverse forest conditions. Beier and Drennan found that mean canopy closures of greater than 40 percent (as opposed to 60 percent) supported quality habitat and recommend managing for higher canopy densities when maintaining or improving goshawk habitat is an objective.

Forest openings appear to be an important habitat feature associated with nest sites. Goshawks often nest close to forest openings such as meadows, forest clearings, logging trails, dirt roads and fallen trees (USDI 1998 Tomassi et al. 1995). Locally, many of the goshawk nests are located immediately adjacent to roads, presumably to facilitate foraging or perhaps as access corridors. Nest sites are found throughout the project area and appear to be spaced to avoid other territories. Woodbridge and Deitrich (1994) found that goshawk nests were minimally spaced approximately 2 miles apart. This corresponds to local data where territory centers (active nests) are on average 1.75 – 2 miles apart, similar to what Woodbridge and Deitrich reported on the Klamath National Forest.

The Creeks II project area has 10 known goshawk territories (Figure 22) that have been discovered through various surveys or incidental sightings. Most recently, the project area was surveyed in 2005, resulting in one additional nest site being found just outside the project area northwest of Ruffa Ranch. In addition, most territories are checked at least semi-annually to record the occupancy status. These annual or semi-annual checks have resulted in identifying many of the alternate nest sites that goshawks use. Nest sites are encompassed in the 200-acre protected activity centers (PAC).

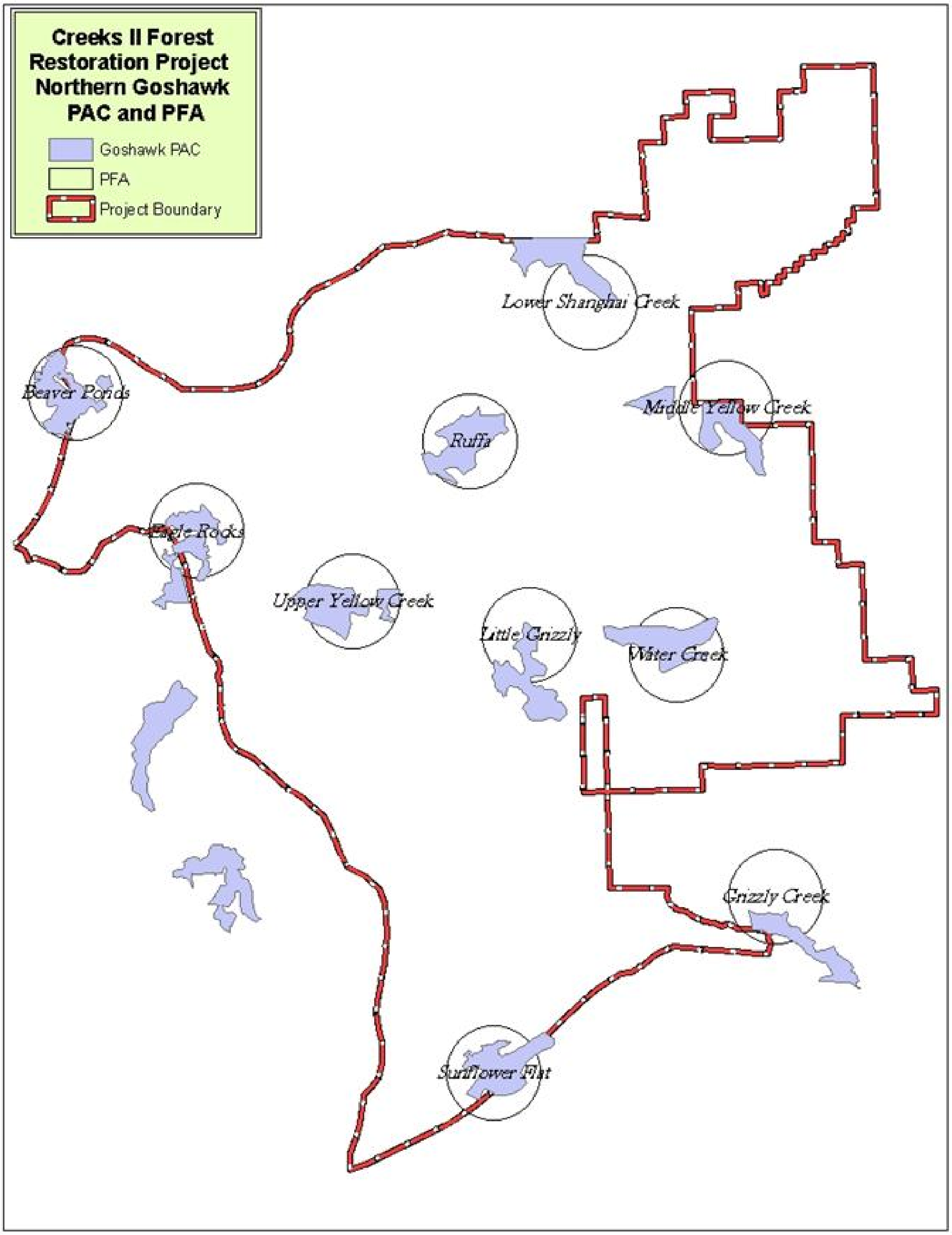


Figure 22. Northern goshawk protected activity centers (PAC) and post-fledging areas (PFA)

Direct and Indirect Effects to Northern Goshawk

The analysis for the 10 territories within or overlapping the project area considers the impact to the area surrounding the nest groves. The area of analysis is represented by the 500 acre individual post-fledging areas (Figure 22). The post-fledging areas is the area immediately surrounding the nest where recently fledged goshawks learn to hunt and it also provides cover for the young goshawks. Models developed expressly to provide a management paradigm indicate a mosaic of habitat that has equal parts of early seral, mid seral, and late seral habitat. Currently post-fledging areas s within the project area are composed primarily of mid seral habitats and generally lack the dense mid and late seral habitat identified in the model (Table 64). Ideally the mid and late seral habitat would be composed largely of stands that exceed 60 percent canopy but have an open understory.

Table 64. Percentage of the post-fledging area (PFA) that meets the model criteria by CWHR

PFA	CWHR					
	1	2	3	4	5	6
Beaver Ponds	6%		27%	18%		3%
Eagle Rocks	27%		10%	18%		
Grizzly Creek	28%		12%	8%		
Little Grizzly			24%	20%		6%
Lower Shanghai Creek			3%	9%		
Middle Yellow Creek	1%		16%	17%		
Ruffa	4%	11%		25%		
Sunflower Flat	5%		1%	34%		
Upper Yellow Creek	1%	9%	3%	31%		
Water Creek			9%	23%		

Note: Stands in CWHR 1, 2, and 3 include all canopy however the model only includes stands with canopy >60% within CWHR 4, 5, and 6 (stands where the average tree size exceeds 12 inch d.b.h..

Alternative 1 would continue the trend of decreasing the mosaic of habitat preferred by goshawks in the various post-fledging areas although the trend would be towards the desired densities within the CWHR size classes 3 and 4. Both early and late seral habitats would continue to be underrepresented according to the model with no substantial trend towards improving the condition. The increase in large trees would be slowed due to the high stand densities, slowing the development of CWHR 5 and 6 habitat, which is also lacking.

Alternative 1 would continue to increase the number of trees in the understory and amount of biomass, reducing the ability for goshawks to navigate. Increases in stand density would occur until density is reduced through self-pruning as described in the silviculture report. However the understory is likely to remain dense and subsequently not favorable to goshawk foraging. Openings adjacent to nests are also an important feature that would decline under this alternative due to the in-growth of conifers, typically white fir. Overall, this alternative would lead to a decline in the quality of the habitat while continuing to increase the overall amount of mid-seral habitat.

Alternatives 2 (Table 65) and 3 (Table 66) are very similar in that they use essentially the same treatments with the exception that alternative 3 includes treatment M in lieu of treatment A within the red fir belt. None of the post-fledging areas would meet the ideal conditions after implementation of either alternative, however the deviation from the current condition is minimal as few of the stands within the post-fledging areas reach 60 percent based on the vegetation layer used in this analysis. The thinning that would occur in the post-fledging areas would increase the ability of the stands to reach the 60 percent canopy ideal sooner and would maintain or improve the understory foraging conditions. Essentially there would be no change to Table 65 as a result of the actions under alternatives 2 or 3.

Although the model represented in Table 63 has been widely used, concerns have been voiced over its applicability. The model was developed under the assumption (based on research by Reynolds et al 1992) that goshawks selected nest sites and territories based largely on prey abundance. Others have disputed this finding that goshawks select for habitat structure rather than prey availability (Beier and Drennan 1997). In those studies maintaining canopies above 40 percent (rather than 60 percent) was considered more important than managing for early seral habitat over 20 percent of the post-fledging area. In either case, alternatives 2 and 3 continue a trend toward higher canopies with very little change in the early seral condition and therefore, regardless of the reason goshawks select habitat, the treatments would continue to support a diverse habitat, a long-term increase in canopy cover, and the open understory they prefer.

Table 65. Acres of treatment; alternative 2

Territories	Treatments								
	A	B	C	D	E	F	GS	O	Total
Beaver Ponds	2	9				20		8	39
Eagle Rocks	0						4		4
Little Grizzly	81			4	35		13	95	170
Lower Shanghai Creek	88	30					8		114
Middle Yellow Creek	46				6		1		52
Ruffa			0	57	48		0	19	124
Sunflower Flat				54	1				55
Upper Yellow Creek	44			22	29		3		99
Water Creek	137	27		29	2		16		207

Table 66. Acres of treatment; alternative 3

Territory	Treatments									Total
	A	B	C	D	E	F	GS	M	O	
Beaver Ponds		9				20		2	8	39
Eagle Rocks	0						5			5
Little Grizzly	22			4	33		13	59	95	228
Lower Shanghai Creek	90	32					7			130
Middle Yellow Creek	46				7					52
Ruffa			0	57	48		0		19	124
Sunflower Flat				54	1					55
Upper Yellow Creek	15			22	29		5	30		101
Water Creek	149	27		28	2		16			222

Group selection activities would not adversely affect habitat for goshawk. Even those papers that suggest maintaining 40 percent canopy cover as an ideal for goshawk habitat recognize that goshawks utilize a wide range of habitats. As shown in Table 64, only the Eagle Rocks and Grizzly Creek post-fledging areas contain the number of acres in size classes 1 and 2 as recommended by the model (Table 63) as shown in Table 65 and Table 66 group selections would add only 4 more acres (size class 1) to the Eagle Rock territory and the Grizzly Creek post-fledging area is not affected by treatments.

The follow-up treatments (site prep, grapple piling, tractor piling, mastication and prescribed burns) would have little impact on the post-fledging areas as there is a limited amount of treatment within each post-fledging area. Some research has shown that understory burning can promote understory vegetation (shrubs and herbaceous plants) however when canopy cover exceeds 40 percent any increase in understory shrubs would be limited. This limit in understory vegetation may reduce the numbers of prey and not lead to a noticeable improvement in forage value. The exception to this may be in the more open areas and group selections that occur next to denser stands. Also each treatment is designed to take advantage of existing openings as a means to enhance stand level diversity. Leave islands are included within all treatments except treatment A and B. Treatment B requires maintaining a canopy at or above 40 percent with a desired canopy of 50 percent or greater and therefore leave islands are expected to occur without designation simply due to areas that would not be treated to meet other objectives. Treatment D occurs within the smaller size class stands that are generally older plantations with little of the characteristics that would provide ideal leave island habitat. Where leave islands are placed, they would provide dense areas for night roosts as well as cover for prey such as rabbits.

The activities in alternative 4 (Table 67) would improve the ability for goshawks to forage by reducing the understory and stand density, however each of the five treatments rely on removing conifers within specific size classes until all trees within the selected size classes are removed or until canopy cover is reduced to 30 percent, whichever comes first. However, the habitat created by this type of treatment is not believed to promote habitat for the prey base (even-aged stands without a shrub or herbaceous understory) and reduces nesting habitat value.

The treatments would be expected to result in an open understory (very similar to treatment A in alternatives 2 and 3) while retaining some overhead canopy. While such treatments would not limit goshawks, such habitat is of low value as it provides no quality nest habitat and limited forage value.

Table 67. Acres of activity within the post-fledging areas; alternative 4

Territories	Treatments					
	1	2	3	4	5	Total
Beaver Ponds	9	8	2			20
Eagle Rocks						0
Little Grizzly	22	64	67	39	31	222
Lower Shanghai Creek	111				7	118
Middle Yellow Creek	1			1		2
Ruffa		19		105		124
Sunflower Flat				54		54
Upper Yellow Creek	14		31	51		96
Water Creek	97		19	2		118

Alternative 4 would not affect stands within the post-fledging areas that currently exceed 60 percent canopy closure nor would there be any change in the amount of early seral habitat therefore the alternative would have no measurable effect on the Reynolds model. However where denser canopy is required in mid seral habitat, this alternative would reduce the amount of suitable habitat (as discussed by Beier and Drennan). This would occur to a greater degree than the other action alternatives, particularly within the post-fledging areas. Overall there would be a reduction of 1,282 acres of potential nesting habitat (stands of CWHR 4M, 4D and 5) within the project area and 115 acres of nest habitat within the post-fledging areas. The majority of loss is associated with the Little Grizzly post-fledging area (56 acres). Treatment in size class five is limited to 9 acres within 1 post-fledging area (Beaver Ponds) but would not result in a reduction of 5M habitat. Although nesting habitat is not a limiting feature, the reduction may adversely affect future nesting potential outside the current protected activity centers. There is a low risk that the treatments in this alternative would lead to territory abandonment. As discussed in the wildlife report, treatments elsewhere on the District, affecting much larger percentages of the post-fledging area, have not resulted in a decline of nesting or occupancy. The implementation of limited operating periods combined with not treating nest areas (protected activity centers) greatly reduces the risk of territory abandonment.

Cumulative Effects

The cumulative effects area of consideration includes four territories in addition to the 10 territories that are within or overlap the project area. There are no discernable effects to these four territories that are outside the project area therefore there would be no cumulative effects to those territories. Cumulative effects considered in the analysis included private lands that fall within the individual post-fledging area s and the potential loss of dense conifer habitat. Also considered was the potential cumulative effects of recreational activities such as hiking, hunting, fishing and camping. Overall, the risk to individual territories due to the activities considered in the four alternatives combined with potential cumulative effects is considered low.

Overall, much of the private lands within the cumulative effects analysis area are progressing toward early successional habitat. Current land management direction for federal lands emphasizes the retention of canopy and trends towards mid and late seral habitat therefore the actions in this alternative are not likely to directly combine with actions on private lands to reduce habitat in the same manner. While the alternatives each result in a reduction of habitat value to various degrees, because the goshawk utilizes a wide range of habitats, the proposed treatments may affect the utility of the habitat but would not result in a loss of suitable foraging habitat. There would be a cumulative loss of nesting habitat which would be greater in alternative 4 than either alternative 2 or 3.

American Marten

Species Status

The American marten, or pine marten as it is often called, is found in deciduous and coniferous forests throughout the northern hemisphere and is endemic to the higher elevations within North America (Zielinski and Kucera 1995). Marten were historically found throughout the Sierra Nevada’s and today occupy much of their historical range. However research conducted by the Pacific Southwest Research Center (PSW) and reported in Zielinski et al. (2005) led researchers to conclude that marten distribution had become fragmented in the southern Cascades and northern Sierra Nevada. This determination came after PSW surveys failed to detect marten between the Lassen Volcanic National Park and the southern portion (Lakes Basin) of the Plumas National Forest. While the paucity of marten on the Plumas National Forest was well known, the Zielinski et al. article contradicted years of local survey data showing that marten were readily detected in many areas within the Lassen National Forest, especially on the Almanor Ranger District.

One factor that may have contributed to the different results in marten detections between surveys conducted by PSW and those completed by local biologists was time of year that the surveys occurred. The surveys by PSW were completed in the summer while surveys conducted by local biologists were primarily completed in the winter. Surveying during the winter is preferred as a means to avoid damage to equipment by bear, a common problem with summer surveys. Experience has also shown that detection rates are much higher during the winter. The discrepancy in the data resulted in the Forest working with PSW to try and discover the reasons behind the apparent seasonal variation in detection.

Over several years (2007 – 2010) summer and winter survey efforts on 2 – 3 different grids consisting of 20 cameras each spaced approximately 2 miles apart in an effort to reconcile the variation in summer/winter survey results. The surveys which covered the Creeks II project area, found the same results; numerous marten detections in the winter with few (1) or no marten found in the summer. Several plausible explanations have been discussed to explain the disparity. Early on, the leading explanation was that adult (reproducing) marten were absent or very rare south of Lassen Volcanic National Park and that winter surveys were detecting juveniles dispersing from high quality habitat within Lassen Volcanic National Park. More recent survey data which includes findings from tracking radio-collared marten challenge this explanation. Other plausible explanations for the difference in detection rates include marten diet changes during the summer that make marten less attracted to baited stations or that marten home ranges expand in the winter and that home ranges in the summer are not large enough to be captured with the current survey methods. This is consistent with Bull (2000), who noted that marten diet during the summer consisted of small rodents such as voles but changed to larger prey during the winter. This seasonal variation in diet has previously been reported and may be related to prey availability (USDA Forest Service 1994). Despite their seeming unwillingness to come to baited camera stations during the summer, current on-going research confirms the Districts' long-held assumption that marten do reside within the project area all year, primarily within the red fir belt.

Despite their seeming unwillingness to come to baited camera stations during the summer, current on-going research confirms the Districts' long-held assumption that marten do reside within the project area all year, primarily within the red fir belt. Continued research will help determine why there remains a seasonal variation in detection rates for this forest carnivore.

To further the knowledge of marten the Forest entered into a cooperative study with Oregon State University (OSU) and the Pacific Southwest Research Center to examine marten habitat use within their territories and at the landscape level. The study is looking at such things as the habitat elements at rest sites and how marten move across the landscape, providing information on connectivity. The study has begun to shed light on marten habitat use and data from the study is being used in the analysis of effects for this project. For instance, a poster (Linnell et al. 2011) was recently presented that provided rest site information including tree size, canopy cover, and habitat used in the snow.

Marten have relatively large home ranges for their size and the size of the home range appears to be highly variable and males typically have home ranges nearly twice the size of females. For example, in eastern Oregon, Bull (2001) found that marten home ranges averaged 10 square miles for males and 5.5 square miles for females. Several studies have estimated that the home range for marten within the Sierra Nevada's varies between .66 square miles and 2.8 square miles for males and between .7 square miles and 2.2 square miles for females (Buskirk and Zielinski 1997). This is considerably smaller than reported for areas on the east side of the Cascade region. Locally a study conducted in the Swain Mountain area (Ellis 1998) calculated annual home ranges at approximately 5.5 square miles for males (3584 acres) and 2.5 square miles (1,536 acres) for females. Bull and Heater (2001) predicted that the size of the home range was contingent on the amount of unharvested forest but their study ultimately indicated otherwise. Contrary to expected results, other elements such as prey availability, the mixture of habitat types, and/or the proximity to other marten (particularly males avoiding other males) had major influences in determining home range size. What Bull and Heater found in their study is also reflective of what has been found elsewhere (Buskirk and Zielinski 1997, Ellis 1998, Bull 2000).

There have been at least five recent credible detections of marten during the summer within the Creeks II project area, all falling within the red fir belt along the western edge of the project area (Figure 23). Marten detected during the summer are assumed to residents as opposed to marten found in the winter, which could be dispersing juveniles. Although the summer sightings have been confined to a small geographical area, capture data suggests these are in fact different individuals (Moriarty personal communication 2010). The sparse summer detections contrast dramatically with winter detections, where marten have been detected throughout the project area.

The effects analysis for marten heavily utilizes the CWHR program developed by California Department of Fish and Game. The model categorizes habitat value by feed (forage), cover, and reproduction and provides one of four values (0, 0.33, 0.66, or 1) for each category. Values 0 - 0.33 is considered low value, 0.66 is considered moderate value, and 1 is considered high value. These three values are then averaged to provide an overall habitat value. This model and its use is more completely described in the wildlife report completed for this analysis.

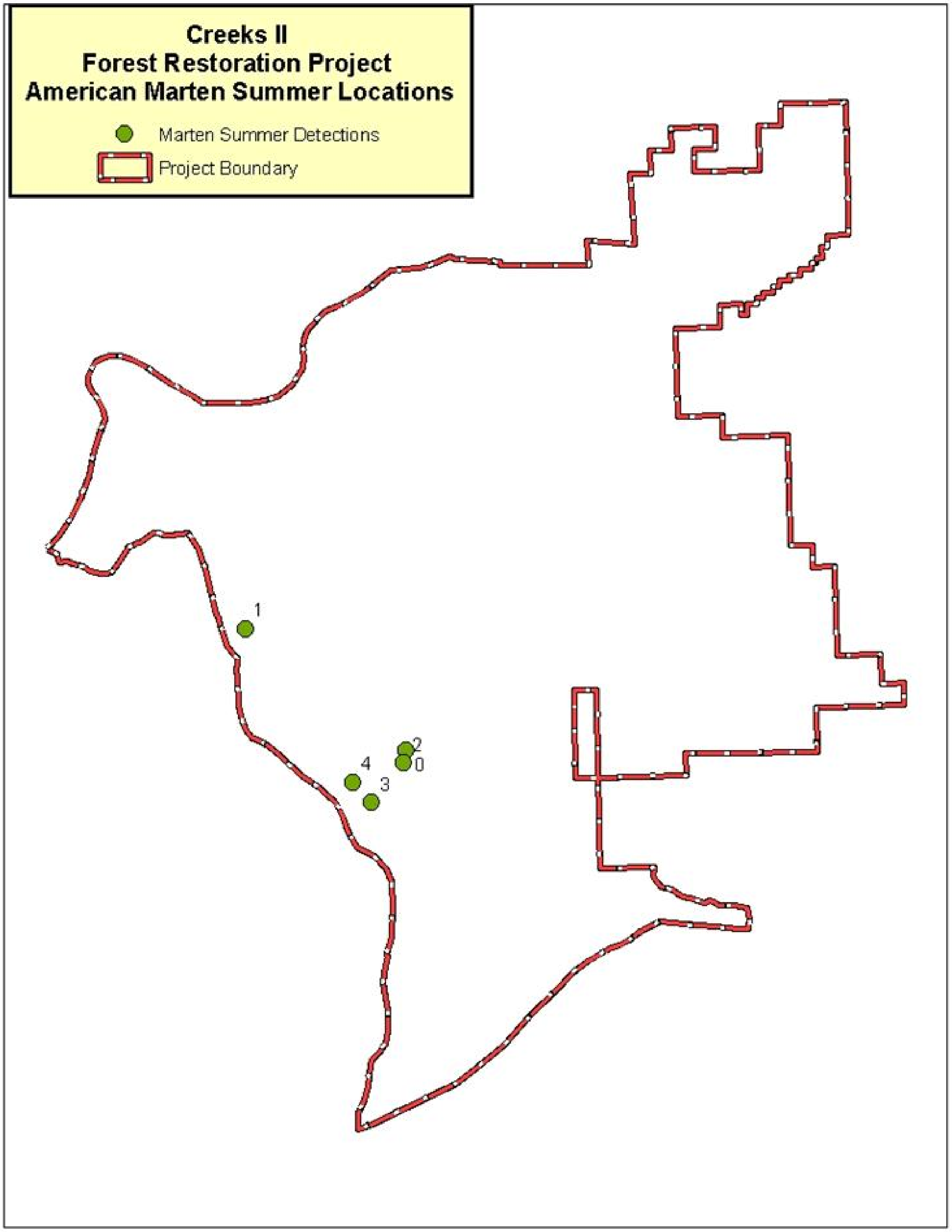


Figure 23. Summer detections of marten within the Creeks II project area

Direct and Indirect Effects to American Marten

Vegetation can be valued through considering the contribution it makes (at the stand or landscape level) for meeting three essential habitat elements; feed (or forage), cover, and reproductive habitat. A review of the information provided through the CWHR program and gained through analyzing the habitat data (see Creeks II wildlife report for specific methods of analysis) indicated that except for reproductive habitat the project area is dominated by habitat of low to moderate value (Table 67). However the elements that provide quality den and rest sites (trees and snags exceeding 30 inches d.b.h.) are lacking and likely in decline based on field reviews and the continuing mortality in the large tree component within many of the stands, particularly the red fir stands. Under alternative 1 the risk of disease and the potential for fires that would reduce the amount of moderate and high quality habitat would continue to grow.

Table 68. Habitat quality for the American marten within the project area

Habitat	Relative Value	Acres of habitat all Lands	Acres of habitat NFS lands Only
Feed	low	9701	8888
	medium	19425	17595
	high	3224	3203
Cover	low	10770	9867
	medium	18356	16615
	high	3224	3203
Reproduction	low	8695	7948
	medium	8222	7471
	high	15433	14267

The wildlife report concluded that alternative 2 would have a marginal effect on marten due to the emphasis on treating habitat of low to moderate value while emphasizing long-term gains in habitat quality. Treatment A would have the greatest adverse affect to habitat due to a reduction of habitat quality (loss of structure and overhead canopy); however that treatment affects only a minor percentage of the overall amount of high quality habitat within the project area. Also, the stands that comprise treatment A are generally of low to moderate value for any of the three habitat types (food, cover, or reproduction). Other treatments while affecting habitat result in effects that are localized (treatment F) or in the case of group selections are spread out and would have a limited affect on available habitat. Group selections sites were chosen for their contribution to habitat diversity and were placed in younger white fir stands. The group selections would affect a limited portion of the stand in which they occur and are not expected to affect marten movements. Based on the site visits completed when establishing the groups, the habitat quality within the proposed groups is of limited value and therefore the reduction in habitat value would not contribute to a loss of important habitat characteristics.

Table 69 provides a summary of the changes, by treatment that would occur throughout the Creeks II project area, under alternative 2. The changes are presented for each habitat type; forage, cover, and reproduction. For example under alternative 2 (Table 69) 1,137 acres of treatment A would occur in stands rated as low forage value. After the implementation of alternative 2 there would be an additional 1,124 acres of habitat considered low forage value (post treatment acres of 2,261 minus the 1,137 acres of low forage value). That would be an increase of approximately 10 percent over current conditions within the project area when compared to Table 68. Similarly there would be a loss of 232 acres of high quality reproductive habitat or a potential reduction of 3 percent of the current amount of high quality reproductive habitat (pre versus post conditions Table 69) associated with treatment A Table 69 and Table 71 not only compare the changes to habitat between alternatives 2 and 3 as a result of implementing the alternatives, the tables demonstrate the focus on treating low to moderate value habitat.

Table 69. Pre and post habitat conditions for the American marten within the project area; alternative 2

Treatments		Habitat type and relative value								
		Forage			Cover			Reproduction		
		Low	Mod	High	Low	Mod	High	Low	Mod	High
A	Pre	1123	1462	410	1265	1320	410	919	1161	915
	Post	1758	1076	161	1900	934	161	1252	1047	695
B	Pre	0	94	0	0	94	0	0	0	94
	Post	0	94	0	0	94	0	0	0	94
C	Pre	101	22	55	117	6	55	55	93	30
	Post	101	77	0	117	61	0	82	94	2
D	Pre	1064	342	0	1141	265	0	1112	248	47
	Post	1111	296	0	1188	219	0	1112	294	0
E	Pre	0	1428	337	0	1428	337	0	566	1199
	Post	0	1428	337	0	1428	337	0	557	1208
F	Pre	230	70	0	230	70	0	135	100	65
	Post	299	0	0	299	0	0	289	0	10
GS	Pre	154	407	79	165	395	79	95	205	340
	Post	640	0	0	640	0	0	640	0	0
O	Pre	263	250	169	269	245	169	214	129	340
	Post	263	234	185	269	228	185	200	125	358

Each of the marten locations indicated in Figure 23 was used as the center point to indicate a territory location. The territory was defined by a 3,584 acre circle. The size of the territory was based on a local marten study completed in the Swain Mountain area. The following tables illustrate the extent to which the alternatives would affect the territories and the extent to which alternative 3 affects the habitat at the landscape level.

Table 70. Amount of treatment in each of the identified territories; alternative 2

Territory		Treatment						Total
		A	C	D	E	GS	O	
0	Acres	447	71	192	208	60	232	**1210**
	%	12%	2%	5%	6%	2%	6%	**33%**
1	Acres	310	71	60	94	28	130	**694**
	%	8%	2%	2%	3%	1%	4%	**19%**
2	Acres	340	71	29	93	36	117	**685**
	%	9%	2%	1%	3%	1%	3%	**19%**
3	Acres	467	71	225	240	56	251	**1310**
	%	13%	2%	6%	6%	2%	7%	**36%**
4	Acres	295		6	16	49		**366**
	%	8%	0%	0%	0%	1%	0%	**10%**

Alternative 3 (Table 71) provides for a greater opportunity to enhance marten habitat by addressing the disease and fuels issues but also providing design criteria that specifically address the retention of key habitat elements. This alternative also retains a higher canopy in those stands with high quality attributes while allowing treatments that would improve long term conditions in those stands lacking quality habitat attributes. With the addition of treatment M, alternative 3 has the greater potential to improve habitat in the short term and retain those key elements into the future. Under this alternative, the amount of high quality reproductive habitat would increase (generally as a result of thinning smaller trees, increasing the overall average tree size, moving it into the next size class). Leave islands also provide a means to retain key habitat attributes such as large logs which provide critical rest and denning structure.

Forage habitat declines under alternative 3 but forage habitat is generally not considered a limiting factor. The changes in reproductive habitat include habitat moving from moderate to both high and low value due to changes in the CWHR values. Reproductive habitat is fairly abundant and the suitability value indicates that project area is providing moderate to high value reproductive habitat overall. Group selections in this alternative would provide for continued small openings in the red fir (groups were generally removed from red fir in alternative 2) which would keep the small openings intact. Field reviews have shown these areas to be rich in rodents, providing abundant prey.

Table 71. Pre and post habitat conditions for American marten; alternative 3

Treatments		Habitat type and relative value								
		Forage			Cover			Reproduction		
		Low	Mod	High	Low	Mod	High	Low	Mod	High
A	Pre	1234	850	0	1374	710	0	933	833	259
	Post	1415	670	0	1555	530	0	1098	603	384
B	Pre	0	97	0	0	97	0	0	0	97
	Post	0	97	0	0	97	0	0	0	97
C	Pre	131	23	54	147	8	54	63	116	30
	Post	131	77	0	147	62	0	87	120	2
D	Pre	953	342	0	1030	265	0	1007	287	0
	Post	999	296	0	1076	219	0	1054	241	0
E	Pre	0	1471	337	0	1471	337	0	541	1267
	Post	8	1463	337	8	1463	337	0	540	1268
F	Pre	276	23	0	276	23	0	135	100	65
	Post	294	5	0	294	5	0	289	4	6
GS	Pre	152	420	88	160	412	88	95	187	378
	Post	660	0	0	660	0	0	660	0	0
M	Pre	32	576	400	34	574	400	14	371	623
	Post	366	471	171	368	469	171	188	486	335
O	Pre	264	384	167	270	378	167	215	99	501
	Post	265	367	183	270	362	183	201	124	491

Table 72. Amount of activity by treatment, under alternative 3 within each of the identified territories

Territory		Acres by Treatment							Total
		A	C	D	E	GS	M	O	
0	Acres	177	71	192	208	63	262	229	**1203**
	%	5%	2%	5%	6%	2%	7%	6%	**34%**
1	Acres	72	71	60	94	34	231	127	**690**
	%	2%	2%	2%	3%	1%	6%	4%	**19%**
2	Acres	84	71	29	94	39	249	114	**679**
	%	2%	2%	1%	3%	1%	7%	3%	**19%**
3	Acres	192	71	225	240	60	267	248	**1303**
	%	5%	2%	6%	6%	2%	7%	7%	**36%**
4	Acres	104		6	16	62	183		**370**
	%	3%		0%	0%	2%	5%		**10%**

Table 73. Acres affecting moderate and high value habitat by treatment; alternative 4

Treatment				
1	2	3	4	5
532	471	915	1,584	87

Alternative 4 would have the greatest impact in terms of reducing habitat value. Although the upper diameter limit for the various treatments in alternative 4 are lower than alternatives 2 and 3 the expectation is (as discussed in the California spotted owl summary) that the effects will be similar to treatment A. Further the focus on separating trees to reduce flame length will further lead to a more homogenous stand (reduced stand diversity) condition and a reduction of cover attributes. Treatments 1 – 4 would also generally reduce canopies to between 30 percent - 50 percent, lower than the treatments used in the other action alternatives (Table 72). Treatments 4 and 5 would have little impact due to the limited impact to suitable habitat and retention of 40 percent canopy.

A review of the proposed treatments in the identified territories (Table 74) suggests that treatment 3 would be used in nearly 50 percent of the moderate and high quality habitat treated within the identified territories. Given treatment 3 has an upper diameter limit of 16 inches, the alternative and this treatment in particular, is likely to have the greatest effect on marten habitat. Conversely some of the benefits of thinning that were identified in the other action alternatives would not be realized. Alternative 4 would not result in an increase in heterogeneity although the alternative would provide long-term benefits of a reduction of mortality risk from disease. There may also be a slight improvement in the rate that the large tree habitat is reached as reduced competition would be expected to increase growth rates where thinning takes place.

Table 74. Acres of habitat affected by treatment; alternative 4

Treatments		Habitat type and relative value								
		Forage			Cover			Reproduction		
		Low	Mod	High	Low	Mod	High	Low	Mod	High
1	Pre	1030	702	3	1112	620	3	822	632	281
	Post	1170	562	3	1253	479	3	860	665	211
2	Pre	343	315	158	344	314	158	242	192	379
	Post	421	262	133	422	261	133	300	186	330
3	Pre	35	564	353	37	562	353	10	400	542
	Post	319	542	91	321	540	91	333	304	316
4	Pre	942	1520	332	1017	1445	332	979	719	1095
	Post	1207	1270	317	1282	1194	371	1145	758	891
5	Pre	93	86	4	96	83	4	75	46	62
	Post	140	43	0	144	40	0	83	80	20

Treatments in alternative 4 would reduce the value of habitat to low or marginally moderate due to the removal of understory vegetation including small logs and other hiding cover such as pockets of dense trees. The treated areas within the estimated home ranges run from a low of 8 percent of the territory (territory 4) to a high of 35 percent (territory 3). Given that the moderate to high value habitat constitutes the majority of each territory (addressed under alternative 1), the impact of this alternative would not be expected to directly eliminate use of the territory or compromise the connectivity of the project area. Overhead canopy would be reduced but remain above 30 percent, considered the lower threshold for marten use. Because understory cover would be lost to a greater extent than the other alternatives, this alternative would increase the risk of predation. The reduction of canopy along with hiding cover would make it easier for predators such as bobcat and great horned owl to catch marten using the treated habitat. This alternative would also reduce rest and den site structure. Although large trees and logs would likely not be affected, the vegetation around them could be substantially reduced.

Table 75. Acres of treatment (moderate – high value habitat) within the identified marten territories; alternative 4

Territory		Treatments					Total
		1	2	3	4	5	
0	Acres	171	298	268	383	22	**1141**
	%	6.62%	11.52%	10.37%	14.83%	0.84%	**44.17%**
1	Acres	71	201	234	158	4	**667**
	%	2.76%	7.77%	9.04%	6.10%	0.14%	**25.80%**
2	Acres	81	187	252	125	6	**651**
	%	3.14%	7.26%	9.75%	4.84%	0.21%	**25.21%**
3	Acres	179	312	275	449	25	**1240**
	%	6.93%	12.06%	10.66%	17.38%	0.97%	**48.00%**
4	Acres	97	0	168	21	3	**290**
	%	3.76%	0.00%	6.51%	0.81%	0.13%	**11.21%**

As shown in Table 75, alternative 4 would affect approximately 25 percent - nearly 50 percent of each of the territories (except 5). Note that the total acres for each territory are not additive as there is considerable overlap between territories 0, 1, 2 and 3. As shown in Table 74, the greatest effect would be to forage and cover habitat.

This alternative would not maintain the structural elements that are retained in the other alternatives, particularly alternative 3 therefore the risk to marten is considered higher in this alternative. The increased risk would be due to greater susceptibility to predators and a reduction of foraging habitat. Rest site structures are likely to remain in place but may be less effective as thermal cover due to the separation of crowns.

Cumulative Effects

The analysis also considered the effect the project may have on connectivity between areas of high quality habitat, in this case habitat on the Plumas National Forest and habitat within the Lassen Volcanic National Park. A least-cost pathway analysis was completed, showing that the project area was within the top 25 percent of pathways predicted to be used by marten moving between high quality habitats. The model demonstrated that the project area does not currently limit connectivity and implementation of alternative 2 would not notably affect connectivity between the areas of high value habitat. Private lands were not generally within the top pathways therefore were not considered as important for marten, limiting the effect of reduced habitat value on private land and overall connectivity for marten at the cumulative effects scale.

The cumulative effects to marten with respect to activities on private lands are hard to predict as there is little private land within the analysis area that provides more than moderate habitat value therefore future actions on private lands are not likely to have a notable affect on marten viability within the project area. Only alternative 4 would likely have a measurable cumulative effect with activities on private lands (no other Forest Service activities affecting suitable habitat are planned within the analysis area). Treatment A in alternative 2 may have a modest cumulative effect in terms of affecting marten movement and therefore provide a cumulative effect with other actions in terms of decreased habitat value, but the retention of canopy along with allowances for snag and down logs would ameliorate this concern.

Pacific Fisher

Species Status

The pacific fisher, a member of the mustelid family that includes the marten, skunks, weasels, and otters, is reported to have historically occupied the lower elevations of the coast range, the foothills, and mixed conifer oak woodlands of the Sierra Nevada (Zielinski et al. 2005). By the 1940s the range of the fisher within California was limited to Northern California east of Interstate 5 and south of Yosemite (Ingles 1947) where it remains today. Only rarely have fisher been documented outside of their current range within California. Trapping and habitat changes are considered the primary culprits for the changes in their distribution.

The fisher is reported to be among the most habitat-specific mammals in North America (USDA 2001). Fisher habitat is characterized by dense conifer and oak woodlands with extensive tracts of mature, largely conifer-dominated, forest (Zielinski et al. 2004). The Lassen National Forest has had a wide ranging carnivore survey program for well over a decade. In addition other research associated surveys have also been completed. To date, with recent exceptions, fisher have not been detected on the Lassen National Forest.

Currently the State of California is considering whether to list the fisher as a threatened or endangered species. The recently reintroduced fisher are considered a research population and therefore the study animals are not considered part of the population considered for listing. The fisher is also a candidate for listing under the Endangered Species Act (USDI 2010). Although federal listing was determined to be warranted, listing was precluded by higher priorities.

In 2009, the California Department of Fish and Game, in cooperation with the USDI Fish and Wildlife Service, Sierra Pacific Industry (SPI), and the University of North Caroline instituted a study (Callas and Figura 2008) designed to look at the effects of private forest management on the fisher. The study design calls for the introduction of approximately 40 fisher over a 3-year period on private lands to the south of the project area (www.dfg.ca.gov).

Despite over 35,000 camera nights through a number of research efforts and project level carnivore surveys, until 2010 fisher had not been detected on the Lassen National Forest. Shortly after the first release, a fisher was detected at a camera station north of the project area (Moriarty 2010 personal communication). The lone detection occurred shortly after the experimental population was released. An individual was reportedly detected at Shanghai Creek, north of the project area, in January 2010. Several other detections were reported over the next few months including detections near Lake Almanor. These movements are thought to be the result of the release, with fisher exploring the local habitat that is unfamiliar to them. Currently the released fisher remain predominantly on private lands near their release site, with the exception of one female that has move to the west near Deer Creek (Facka 2011). As expected, all fisher remain below the elevation of the project area.

The analysis for the Creeks FEIS (USDA Forest Service 2005) determined that the project area, which mirrors the current project area, was not suitable for fisher. At that time, fisher had not been reported on the Forest for many decades and they were considered extirpated. The introduction of the fisher in areas just outside the Forest boundary and the detection of fisher in and around the project area requires a reconsideration of that determination. The original analysis determined that the project area lacked suitable habitat due to several key factors. The main reason was the snow depth and the belief that fisher are limited by the deep snows common in the Sierras. The conclusion that the project area provides limited habitat due to the snow conditions remains reasonable. Krohn et al. (1997) reviewed historic and contemporary fisher sightings and found that the mean monthly snowfall at fisher detection sites was less than 12 cm (approximately 5 inches) where as the mean monthly snow fall for marten was somewhat less than 30 cm. (approximately 12 inches). Snow typically begins falling within the project area by late November and typically exceeds more than 12 cm (approximately 5 inches) per month. The project area typically accumulates eight or more feet of snow between the months of December and March, therefore the project area likely would not be able to support fisher due to snow depth.

The most recent habitat models also indicate that the project area would not provide suitable habitat. In Carroll's reanalysis (2005) of his 1999 model he found that the model worked well for the redwood area (north coast of California) but for habitat within the Sierras a ruggedness measure to identify fisher habitat was added. The maps of suitable habitat within the northern Sierras based on the refined model indicate that the project area would have low suitability for fisher. The Davis model (2007) which covers broad areas for northern California relies on a number of different elements including precipitation, hardwoods, canopy densities, and the presence of roads. These habitat suitability models currently represent the best available science for Pacific fisher in this region (Kirk 2010). To determine if either model would predict suitable habitat within the project area, Kirk (2010) contacted both authors and was given the GIS layers depicting suitable habitat based on the respective models. Neither model identified suitable habitat within the project area. Only the Davis model predicted any habitat (approximately 135 acres) within two miles of the project area (Figure 24).

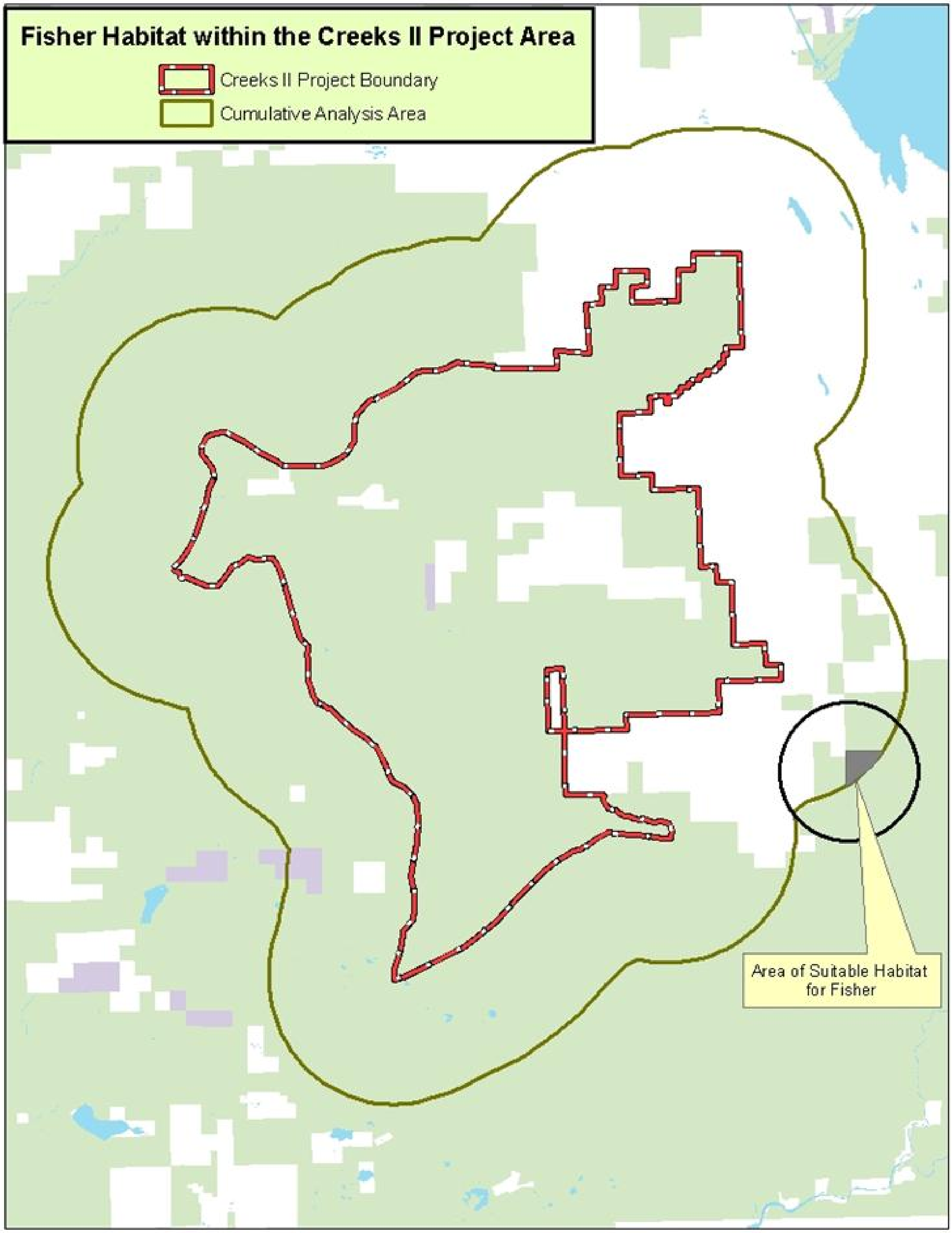


Figure 24. Modeled habitat for Pacific fisher

Figure 24 shows the project area (red boundary), cumulative effects buffer area (Black line), modeled high suitability habitat (green boundaries) and suitable habitat within the cumulative effects buffer (Yellow polygon with red outline).

Direct and Indirect Effects to Fisher

Based on the most recent habitat models and research on fisher habitat, the project area provides neither suitable habitat, nor does it provide a likely corridor to and from areas of high quality habitat. Therefore none of the alternatives would provide any direct or indirect effects.

Cumulative Effects

Because no direct or indirect effects are anticipated, there would be no cumulative effects to the fisher.

Willow Flycatcher

Species Status

Habitat for the willow flycatcher is generally described as willow thickets along streams and lakes. Within the breeding territories surface water or saturated soil is almost always present. Locally willow flycatcher habitat is characterized by broad, wet meadows with running water and willow and willow/aspen complexes. With one exception all occupied sites on Forest Service lands have beaver dams. The exception to this “rule” is along the north end of Lake Almanor where willow flycatchers nest in the willows along the high lake level. Willow flycatchers are migratory, arriving in late May or June, depending on the weather. The local area provides considerable habitat for nesting, the primary reason willow flycatchers come to the area.

Like many birds, willow flycatchers are at risk from a variety of predators. Perch trees adjacent to an occupied territory provide hawks or other avian predators with excellent hunting platforms. Dense brush and trees can also hide or provide habitat for other predators such as cats, including bobcat or even domestic (house) cats. However the biggest threat to willow flycatchers appears to be from nest predation (Cain et al. 2003). Numerous birds, mammals, and reptiles such as snakes, raid the nests that are typically only 3 – 10 feet above the ground. Brown headed cowbirds are also considered one of the leading threats to nest success as they will lay their eggs in the nest and the cowbird chicks will either eject the flycatcher young or simply out-compete them for the food the adults bring. Cowbirds are uncommon in the area and aren’t currently considered a local threat to the flycatcher.

There is one known occupied site within the project area, on a tributary to Butt Creek. Surveys have been done annually by either Forest Service personnel or Point Reyes Bird Observatory (PRBO) Conservation Science biologists since 1993 and the site has been occupied since 1994. One or more, commonly 2, males (indicating two nests), have been detected every year that surveys have been completed. The site has been called the Beaver Ponds as the location has numerous beaver lodges and a healthy stand of willow surrounded by aspen of varying ages.

Direct and Indirect Effects to Willow Flycatcher

One willow flycatcher site occurs within the project area, on a tributary to Butt Creek west of Ruffa Ranch. The site, referred to as the Beaver Ponds for the numerous beaver lodges, has the slow running water and willow/aspen vegetation that is common with other willow flycatcher sites on the District. Surveys try and determine the number of nesting pair through the responses of territorial males to recordings of other willow flycatchers (Bombay et al. 2002).

Aspen have flourished after cattle were prevented, through fencing, from accessing the occupied willow flycatcher site in the late 1990s. The allotment is currently closed. In addition to aspen, conifers have also increased, providing both perches and hiding cover for predators immediately adjacent to the site.

Alternative 1 would continue the current trend and increase habitat for predators, leading to an increased risk of predation of individuals and nest predation. Long term declines in habitat value may occur due to slow increases in conifers. Alternatives 2 and 3 would reduce the conifers around the edge of the site as part of the aspen enhancement (treatment F). This would reduce the threat of predation and may increase the amount of suitable habitat for willow flycatcher, allowing for more territories. Aspen treatments are generally carried out in the late summer or fall to avoid wetter soils. This would avoid conflicts with nesting flycatchers. Alternative 4 does not include the aspen treatment and there are no activities within ¼ mile of the occupied site therefore the effects would be similar to alternative 1.

Cumulative Effects to Willow Flycatcher

Because none of the alternatives directly affect the willow flycatcher site and it is not feasible to quantify any risks or benefits that may result from direct or indirect effects, cumulative effects are difficult to predict. There are no private lands that would impact this site. The site is adjacent to a county road (Humboldt Summit Road) that receives the bulk of the traffic within the project area. This traffic, which includes recreational users as well as work related traffic, would increase under the action alternatives. However the consistent record of occupancy of the site indicates that traffic does not inhibit willow flycatchers, at least at this site, and the additional amount of road activity is unlikely to cumulatively impact the willow flycatcher.

Terrestrial Management Indicator Species (MIS)

Methodology

The Record of Decision (ROD) for the Sierra Nevada Forests Management Indicator Species Amendment (SNFMISA; USDA Forest Service 2008) outlines the procedures for analyzing the effects to MIS. Prior to the MIS amendment to the Forest Plan, analysis considered impacts to individuals whereas the current direction provided by the ROD relies on analyzing the impacts to habitat and comparing the loss to habitat trends throughout the Sierra Nevada. Impacts to species are based on bioregional trends as outline in the SNFMISA.

This section summarizes the findings of the terrestrial species portion of the Management Indicator Species (MIS) report prepared for this project (located in the planning record). The Forest Plan (USDA Forest Service 1993) originally identified 18 MIS for the Lassen National Forest. In 2008 the Forest Plan was amended with new direction for MIS. Habitats were defined for specific species and the analysis focuses on changes in habitat rather than the impact to individuals. The MIS report prepared for this project determined that 7 terrestrial MIS habitats could be affected. The effects to species are considered at the bio-regional (Sierra Nevada) scale based on the change in habitat trends.

Cumulative effects were based on the activities that are expected to occur on both private and federal lands within the project area.

Direct and Indirect Effects to Management Indicator Species

Table 76 outlines the various MIS habitat found within the project area and whether habitat would be affected by treatments.

Table 76. List of MIS habitats within the project area

Sierra Nevada Forests Management Indicator Species Scientific Name	Habitat or Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component
fox sparrow *Passerella iliaca*	Shrubland (west-slope chaparral types)	montane chaparral (MCP), mixed chaparral (MCH), chamise-redshank chaparral (CRC)
yellow warbler *Dendroica petechia*	Riparian	montane riparian (MRI), valley foothill riparian (VRI)
Mountain quail *Oreortyx pictus*	Early Seral Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, and 3, all canopy closures
Mountain quail *Oreortyx pictus*	Mid Seral Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 4, all canopy closures
Sooty (blue) grouse *Dendragapus obscurus*	Late Seral Open Canopy Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P
California spotted owl *Strix occidentalis occidentalis*	Late Seral Closed Canopy Coniferous Forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), tree size 5 (canopy closures M and D), and tree size 6.
American marten *Martes americana*		
northern flying squirrel *Glaucomys sabrinus*		
hairy woodpecker *Picoides villosus*	Snags in Green Forest	Medium and large snags in green forest

The reliance on CWHR to outline the amount of habitat available for the selected MIS must also be accompanied by a description in the change in habitat elements that provide quality habitat. For example, quality habitat for mountain quail includes not only conifers but also shrubs and forbs. These are preferred habitat characteristics that provide food, cover, and nesting habitat (CDFG 2008). Due to continued increases in stand densities and the decline of understory vegetation, all three of the action alternatives would lead to limited improvements for mountain quail habitat.

Table 77 provides an estimate of the changes to MIS habitat after the implementation of each alternative. The table reflects the number of acres within the treatment unit (top number) and the overall number of acres in the project area (in parentheses). In the columns entitled "Change in MIS Habitat Acres" the numbers in parentheses indicate the acres of habitat reduced. Other numbers indicate gains in that habitat. The limited amount of montane riparian habitat proposed for treatment would improve in habitat value (aspen) but for purposes of this analysis would not increase (aspen would continue to be an inclusion within the broader montane riparian vegetation type) under alternatives 2 and 3 (alternative 4 does not propose treatments within montane riparian habitat). Understory shrubs and herbaceous plants would also benefit as there is expected to be an increase the species diversity within the riparian ecosystem.

Alternative 1 would lead to continuing declines in the open habitat with large trees due to the continuing increase in young conifers, primarily fir. Habitat for the sooty grouse more than doubles under alternatives 2 and 3 but sooty grouse habitat is still less than 3 percent of the overall habitat within the project area. The gains are made primarily through thinning of dense stands dominated by smaller trees (classified as 4M stands). After thinning, canopy is reduced and the larger trees become the dominant feature. Alternative 4 result in the addition of approximately 236 acres of additional habitat for sooty grouse, approximately a 75 percent increase over current conditions within the project area.

Table 77. Change of MIS habitat within the project area by alternative on National Forest System lands

MIS Habitat –	Acres of Habitat within Project Area (ALT 1)	Post Treatment MIS Habitat Acres (ALT 2)	Change in MIS Habitat Acres	Post Treatment MIS Habitat Acres (Alt. 3)	Change in MIS Habitat Acres	Post Treatment MIS Habitat Acres (Alt. 4)	Change in MIS Habitat Acres
Riparian	370 (370)	370 (370)	0	370 (370)	0	370 (370)	0
Early Seral Coniferous	3,950 (4,240)	4,458 (4,748)	508	4,488 (4,778)	538	3,916 (4,206)	(34)
Mid Seral Coniferous	22,654 (24,788)	21,315 (23,449)	-1,339	21,150 (23,284)	(1,504)	22,264 (24,398)	(390)
Late Seral Open Canopy	320 (321)	838 (8439)	518	905 (906)	585	546 (547)	236
Late Seral Closed Canopy	1,496 (1,531)	1,748 (1,783)	252	1,876 (1,911)	380	1,684 (1,719)	188

The numbers represent the amount of habitat on NFS lands (no parentheses) and all lands including private (cumulative effects) in parentheses.

The dense late seral habitat would continue to develop under alternative 1 although some of the key elements, such as large trees, would either stagnate or develop more slowly over time. The risk of loss of this habitat from disease and fire increases over time due to increasing stand densities. Dense late seral habitat would increase under alternatives 2 and 3 primarily from thinning very dense stands that have a substantial large tree component but are dominated by smaller trees. Thinning the smaller trees increases the average tree size giving the perception, based on tree diameter averages, that there is an increase in late seral habitat.

The greatest increase in the number of snags 15 inches d.b.h. and larger would likely occur under alternative 1 as mortality is expected to increase over time. This is likely to come at the expense of other attributes such as the larger trees that provide nesting habitat. Alternatives 2 and 3 would maintain a minimum of 4 – 6 snags per acre comprised of snags 15 inches d.b.h. and greater. Typically, snag numbers are too low to meet this requirement therefore most snags, excepting those that are deemed a danger, are left in place. Alternative 4 would maintain the minimum number required and therefore would likely have the greatest impact within the stands being treated.

Snag numbers would likely rise during the implementation of prescribed burns. Conifer mortality would occur during the prescribed burns, especially within the leave islands that have sufficient fuels.

Cumulative Effects to MIS

The cumulative effects area of consideration for MIS is the project area. The Forest Service is responsible for managing 92 percent of the lands within the project area. Approximately 7 percent of the project area is owned by timber companies with the remaining 1 percent in various private and state-owned lands. Approximately 75 percent of the industrial timber lands within the project area provide mid-seral (mountain quail) habitat. This would likely continue into the future although the habitat may attain more early seral characteristics should the lands be harvested.

There would be little cumulative effects to any habitat except the early and mid seral habitat. There are no known activities planned on federal lands in the project area and there are no expected changes in the limited amount of other habitats that are found on private lands. These include WHR habitats montane riparian, montane chaparral, montane hardwood conifer, and forest habitats.

Determination of Effects to MIS

Although habitat value was likely to decline due to short term changes under all alternatives, the MIS report determined that none of the alternatives would result in a change in habitat trend for any of the MIS considered or change current population trends of MIS at the bioregional scale.

Migratory Birds

A review of the projects' potential effects to migratory birds was completed for this project. The review determined that alternatives 2 and 3 would provide increases in the amount and quality of habitat for migratory birds. Alternative 4 would also increase habitat but to a lesser extent and the quality of the habitat created would be less. This determination was based on reducing canopies, potential increases in understory vegetation, retention of snags and downed logs, and increases in 5S and 5P habitat, which are characterized as having sparse to open crown closure, with trees over 24 inches d.b.h. on average.

Watersheds and Fisheries Resources

This analysis documents potential effects from this project's activities on the hydrology, riparian, and aquatic habitat within the Creeks II project area. The report describes the existing condition of the watershed in terms of beneficial uses, hydrology, and sediment delivery to streams, riparian habitat, and habitat for aquatic species.

The Creeks II project area is located on portions of ten sub-watersheds that contribute to Yellow Creek, Butt Creek and the North Fork Feather River and ultimately drain into the Sacramento River (Figure 25). Land ownership in the project affected sub-watersheds includes lands managed by the Lassen National Forest (48,506 acres), private (28,662 acres), and the state of California (74 acres). The majority of private lands are managed for timber production with the exception of Humbug Valley that historically has been managed for grazing resources. A description of the climate and topography of the project area is included in chapter 1 under location and description of the project area.

Beneficial uses of water originating in the project area include power generation, agriculture (irrigation and stock watering), freshwater habitat (warm and cold), migration (cold), spawning habitat (warm and cold), wildlife habitat, riparian hardwoods and recreation (contact and noncontact). The project area supports native and introduced non-native trout species, and provides habitat for Forest Service (Region 5) sensitive amphibian species, including Cascades frog and Sierra Nevada yellow-legged frogs.

Van De Water and North (2010) recently published a study analyzing fire return intervals within riparian areas compared to those observed in the adjacent uplands. Data used for this study were collected within three areas of the northern sierras, and included the Almanor Ranger District of the Lassen National Forest, Onion Creek Experimental Forest, and the Lake Tahoe Basin. Their data shows that fire return intervals within riparian and upland areas are, in general, closer than previously believed. Of note, is that four sample sites included in the study were located within the Creeks II project area. Two of these sites (Shanghai Creek and Sawmill Tom Creek) had fire return intervals within riparian areas that were lower than those in the adjacent upland.

Recent publications have addressed the impact that fire exclusion has had on riparian areas across landscape in the western United States. In general, these studies concluded that the existing condition of forested riparian areas does not reflect historical, or natural, conditions that were primarily maintained by frequent to periodic fire return intervals of low to moderate intensities (Dwire and Kauffman 2003; Stephens and Moghaddas 2005; Van de Water and North 2011). Van de Water and North (2011) compared current stand conditions and fuel loadings to reconstructed conditions prior to wildfire suppression. They determined that current conditions within riparian areas were significantly different than historic or reconstructed conditions. Basal area, stand density, and total surface fuel loading were all found to be higher under current conditions when compared to the reconstructed conditions presented by Van de Water and North (2011). Furthermore, as a result of successful wildfire suppression and lack of vegetation management activities, riparian areas are more fire prone than adjacent uplands.

Management Direction and Laws

The project is consistent with all management direction concerning soils, fisheries and hydrology.

The regulatory framework guiding this analysis is provided by the 1993 Lassen Forest Plan, as amended by the Herger-Feinstein Quincy Library Group Forest Recovery Act FEIS (1999), FSEIS (2003) and RODs (1999, 2003) and the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS (2001), FSEIS (2004) and ROD (2004). All sub-watersheds would be managed through standards and guidelines defined in appendix L of the 1999 HFQLG FEIS (also known as SAT guidelines). Further direction is provided by Region 5 Soil Quality Standards (USDA Forest Service 1995) and Region 5 Best Management Practices (USDA Forest Service 2000a).

The State and Regional Water Quality Control Boards entered into agreements with the USDA Forest Service to control nonpoint source discharges by implementing control actions certified by the State Water Quality Control Board and the EPA as best management practices (BMPs). BMPs are designed to protect and maintain water quality and prevent adverse effects to beneficial uses both on-site and downstream. In addition, the land disturbing activities would be dispersed in time and space so that the sub-watersheds would not reach or exceed the threshold of concern for overall disturbance.

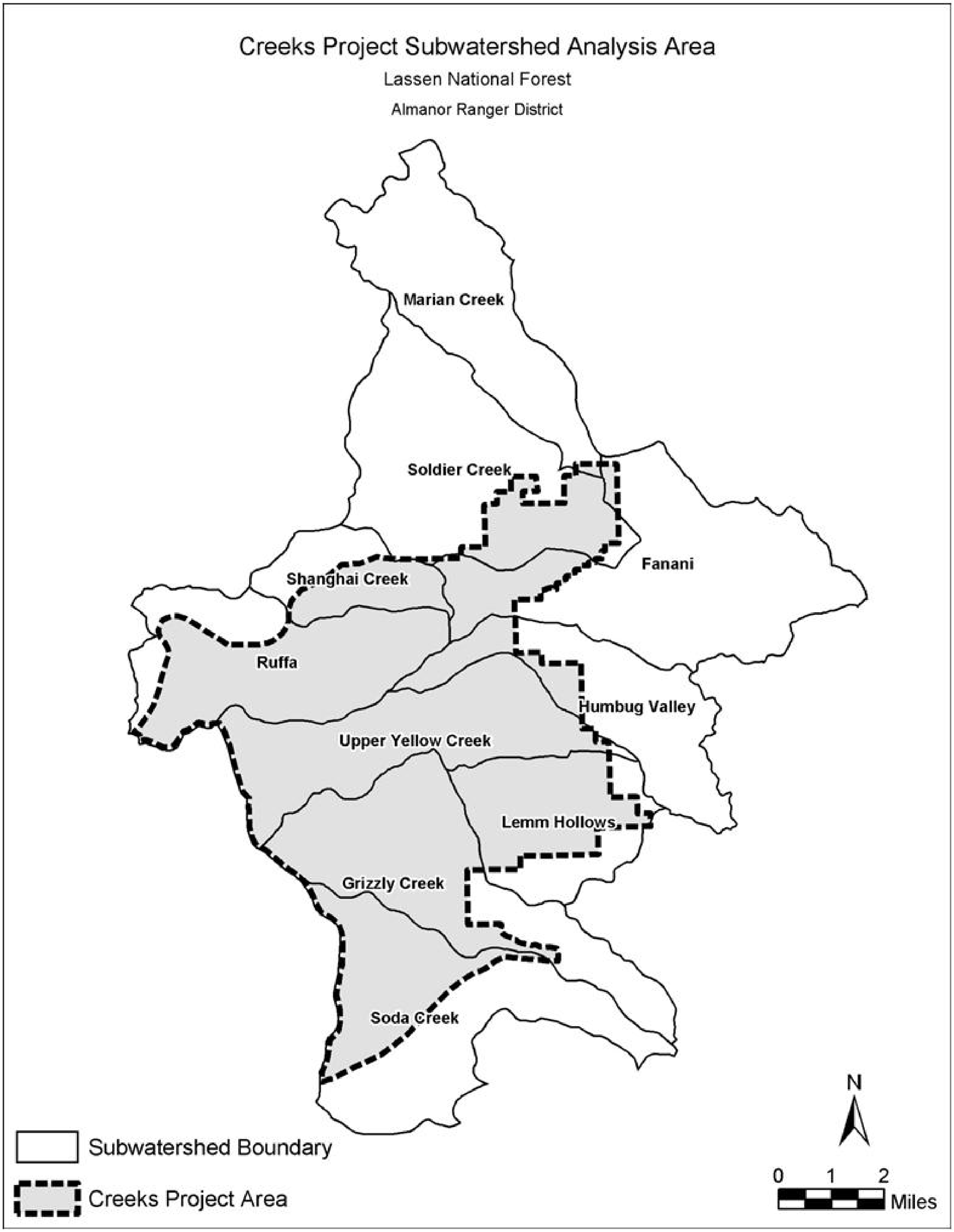


Figure 25. Project sub-watersheds, taken from original Creeks EIS

Methodology

Effects at the subwatershed scale to aquatic and riparian resources following implementation of proposed activities were determined based on existing condition data, local knowledge of the project area, aquatic and monitoring results, and the latest research.

Scope of Analysis

The effects analysis in the watershed and fisheries report (located in the planning record) analyzes effects at the subwatershed scale, primarily evaluating riparian habitat, in-channel conditions, and water quality. Beneficial uses of most concern (aquatic communities) are supported at this scale, and changes in the mechanism of concern (surface erosion and compaction) can be detected. At larger scales, influences are diluted. A primary assumption of this analysis is that protection of beneficial uses at the sub- watershed scale also results in protection of uses at larger scales, in this case, downstream beneficial uses in Yellow Creek, Butt Creek and the North Fork Feather River. The watershed and fisheries section of this EIS will focus on and summarize the effects related to purpose and need indicators and analysis issue indicators discussed below.

Issues

Issues that are of particular concern are cumulative watershed effects from all past, present, and proposed activities in the project sub-watersheds. Cumulative watershed effects in the Grizzly Creek sub-watershed were brought up by the public in earlier scoping efforts. These are considered in the following analysis.

Cumulative Effects

The cumulative effect analysis area for the Creeks II project includes the ten sub-watersheds outlined above. This analysis considers the various alternatives in addition to past, present and reasonably foreseeable actions, using the process prescribed for the Pacific Southwest Region of the Forest Service (USDA Forest Service 1988). Past activities included in the analysis are listed in appendix C.

Cumulative effects are estimated at the subwatershed scale and examine disturbance that has occurred within the last 30 years and expected disturbance five years into the future. Cumulative effects are analyzed using many metrics and indicators of watershed condition. One of the methods used is the widely accepted Equivalent Roaded Acre model (ERA).

Activities analyzed include roads, OHV trails, logging on both public and private ground, and grazing. Timber harvest records for private lands are available for the ten previous years. Activities occurring on private lands before 2001 have been estimated based on prior harvest levels.

It is assumed that private industry would continue as they have in the past. There are fuels reduction activities that are occurring in the Storrie Fire area. These have been included in the cumulative effects analysis where they overlap with the Creeks II sub-watersheds.

Measurement Indicators

The measurement indicators for potential treatment effects on riparian and aquatic resources are listed below: The effects of the Creeks II project on riparian and aquatic resources as it relates to these indicators are summarized in this section. More detailed analysis of effects is located in the watersheds and fisheries report located in the planning record.

Road density

Roads have compacted surfaces that can contribute runoff, and often include drainage structures (ditches, relief culverts, etc.) that concentrate flow and increase the drainage network, potentially leading to increased sediment production. Depending on the density of roads (miles per square mile) within a given subwatershed these impacts can be magnified and potentially lead to decreased aquatic habitat value downstream.

Equivalent Roaded Acres (ERA)

Disturbance from past, present, currently proposed, and foreseeable future project activities within a sub-watershed are estimated using equivalent roaded acres by relating the relative magnitude of the activities to an acre of road disturbance. This is accomplished by applying “disturbance” coefficients to each type of ground-disturbing activity. Under this method each affected sub-watershed is given a threshold of concern value based on watershed sensitivity indicators (soils, slopes, unstable lands, beneficial uses at risk, etc.). The closer the calculated equivalent roaded acres value for the sub-watershed is to the threshold of concern, the higher the risk of adverse cumulative impacts to watershed and aquatic resources at the sub-watershed scale. Disturbance from activities on private lands within the project area was factored into the model using information contained within timber harvest plans obtained from CALFIRE (Northern Region Headquarters, Redding, CA).

Short-comings of the equivalent roaded acres model include the assumption that all roads are considered equal and are assigned a disturbance factor of 1. The equivalent roaded acres model does not differentiate between near stream roads, which have been shown to have higher sediment delivery to streams, and roads located outside the RHCA. Nor does the equivalent roaded acres model differentiate between the condition or type of road. In the equivalent roaded acres model, roads with recent road drainage improvements that reduce sediment production are assigned the same disturbance coefficient as roads with poor drainage, high sediment production and high sediment delivery. Road improvements such as storm-proofing and aggregate surfacing have been shown to decrease the risk of erosion (McDonald and Coe 2005, WEPP model, USDA Forest Service 2006).

The equivalent roaded acres model may also over emphasize the effects due to mechanical thinning operations. Recent research done on the Lassen and forests immediately adjacent, found very little quantifiable impact from modern logging practices on forest service lands to streams throughout the HFQLG area, and BMPs were shown to be effective (Litschert and MacDonald 2009).

Fires may also recover faster than the assumed recovery coefficient of 25 years. Wildfire recovery, especially low to moderate burns, may recover on the 3 to 5 year scale as opposed to 25 years.

Sediment

Recent timber harvest activities compared to roads have not been found to be the major contributors of sediment to streams, especially with the implementation of Region 5 Best Management Practices and project specific Integrated Design Features. Monitoring of the implementation and effectiveness of BMPs within the HFQLG project area, and on the Lassen National Forest have found that BMPs for practices associated with timber harvest (which include landings and skidtrails) have consistently met their on-site objectives for reducing erosion when properly implemented. Monitoring conducted between 2004 and 2009 found that BMPs were implemented on 97 percent of skid trails and landings associated with timber harvest projects. A peer reviewed paper was also published recently that examined the connection between modern Forest Service mechanical harvest operations and erosion features. The research was partially conducted on the Almanor District. The study looked at 200 harvest units and found only six erosional features that reached stream habitats. All six features were described as rills, with five originating from skid trails and one originating from a clear-cut unit. Most of these features were associated with highly erosive granitic soils (Litschert and MacDonald 2009) that are not present within the Creeks II project subwatersheds.

Timber operations are subject to increased restrictions within RHCAs to limit sediment production and delivery. Monitoring of 18 randomly selected timber operations in RHCAs on Lassen National Forest samples in 2005-06 (none were monitored in 2004) found BMPs to be implemented at all 18 sites.

Recent research (MacDonald and Coe 2005), supported by local and regional field evaluations, have consistently found roads to be the primary source of accelerated erosion in wildland watersheds. During winter haul operations, Luce and Black (1999) found sediment production (not delivery) increased about seven times as a result of winter haul and road maintenance (especially ditch clearing). Luce and Black (2001) found sediment production recovered rapidly towards pre-project conditions over time: 50 percent in first year, 90 percent in three years.

Many studies have shown that near-stream roads and crossings are the areas where management can affect watershed health. Research indicates that surfacing at crossings may reduce delivery of sediment to channels by 10-25 times the existing condition (MacDonald and Coe 2005).

Habitat attributes in RHCAs

Stand conditions within riparian habitat conservation areas (RHCAs)

Analysis of data collected in the project area found that stand conditions within RHCAs are heavily overstocked, dominated by small diameter trees <5 inches d.b.h. and contain surface fuel and ladder fuel concentrations that may contribute to high intensity wildfire. Thinning and fuel reduction activities within RHCAs is expected to result in trending existing conditions to historic (pre-fire suppression) conditions by decreasing stand densities and fuel loading, increasing average stand diameters, and improving forest health. These actions should improve how these stands influence habitat attributes both within and outside of stream channels, including canopy cover, water and air temperature regulation, bank stabilization, terrestrial species habitat, wild fire resiliency, and influence of fluvial geomorphic processes.

Large wood recruitment

Large woody debris is important to the aquatic environment because it routes and stores sediment, provides habitat complexity, and acts as a substrate for biological activity. Characterizing large woody debris recruitment is valuable in determining the potential for the existing stands adjacent to the creek to contribute future large woody debris to the channel.

Channel shade/canopy cover

Vegetation growing within close proximity of stream channels plays an important role in regulating channel shade, air temperature, and relative humidity. Land management activities that include manipulation of vegetation in close proximity to aquatic habitats may result in changes to canopy cover and species compositions. Potential consequences of these actions include changes in the intensity of direct and diffuse light that reaches water bodies, changes in available resources for vegetative species, and changes in ambient air temperatures following alteration of stand characteristics.

Affected Environment

Existing Condition

Project area sub-watersheds support both perennial and seasonally flowing streams (see Table 78). Wet meadows, springs, seeps, and fens exist in several locations in the project area, often associated with wet stringer meadows in valley bottoms. Riparian Habitat Conservation Areas (RHCAs) provide protection to these habitats, as noted in integrated design features for the proposed action (see Table 79).

Table 78. Miles of seasonal and perennial flowing stream channels on Lassen National Forest lands within subwatersheds affected by the Creeks II project area

Stream Type	Stream Miles
Seasonally Flowing	98
Perennial	48

Source: Almanor Ranger District GIS

Table 79. Summary of RHCA designations within the Creeks II project area

Type of RHCA	Inner zone width	Outer zone width	Total width
Wetland / meadow less than one acre in size	50ft	50ft	100ft
Wetland / meadow greater than one acre in size	75ft	75ft	150ft
Perennial stream	150ft	150ft	300ft
Seasonally flowing stream	50ft	50ft	100ft
Fen	n/a	n/a	150 ft

Information on current water quality guidelines and stream segment status was collected from the Environmental Protection Agency, California Regional Water Quality Control Board, and from local data collected on the Lassen National Forest.

There are no water bodies that have been labeled as impaired or placed on the 303d list by the Central Valley Regional Water Quality Control Board within the project area and there are currently no listed segments downstream that could be impacted by this project. In January of 2009, the Central Valley Regional Water Quality Control Board proposed listing the North Fork Feather River as an impaired water body on California's 303(d) list for water temperature, mercury and unknown toxicity (Central Valley Regional Water Quality Control Board 2009). This has not occurred as of May 2011, and potential sources of these pollutants are not believed to be within the project area or on the Lassen National Forest.

Hydrologic field surveys were made during June, August, and October of 2004. The surveys were conducted onsite to determine current condition of the watershed and soil resources, and to evaluate the potential effects from proposed vegetation management activities. Additional surveys of roads and road crossings were made during the 2007 field season and some areas were revisited during 2008 and 2009. Information was collected at crossings to run the Water Erosion Prediction Project (WEPP, USDA 2006) model to estimate erosion at these sites. Riparian Habitat Conservation Areas (RHCAs) were inventoried during the summer and fall of 2007 to assess stand conditions, fuel concentrations, and to prioritize treatments. Stream habitat inventories (Lassen National Forest Streamscape, and R5 Stream Condition Inventory Protocols) were conducted on perennial streams in the project area in 1997, 2001-03 and 2008-2010 (data is summarized in the watershed and fisheries report in the planning record).

Water quality

Sediment

Impacts to water quality on Forest Service jurisdictional managed lands in the project area are occurring and are associated with the Storrie Fire; sediment delivery at road stream crossings and from roads located near streams; and sediment delivery from unstable channel banks, specifically in low-gradient reaches. Sediment delivery from roads and harvest areas on private lands is also occurring within many of the sub-watersheds. Of the 380 miles of roads within the project area, there are 112 miles of road within RHCAs. The majority of road miles within perennial RHCAs are associated with the heavily traveled roads along Yellow and Butt Creeks. The remaining are generally located adjacent to seasonal streams and approaches to stream crossings. Field reconnaissance conducted in 2007 inventoried 102 road crossings containing culverts. There are approximately 30 other crossings in the project area that have bridges, low water fords or native surface (at ephemeral channels). Sediment delivery at stream crossings results from road drainage features such as inboard road ditches and crossing fill slope material eroding into stream channels. The majority of sediment delivery appears to be coming from road surface and road fill slope materials that are detached and transported to the channel after heavy road use, wet season road use, or precipitation events of great enough intensity to produce runoff. Graveled road segments appear to be delivering less sediment, but the gravel surface on many of these segments is thinning and may be losing its effectiveness in reducing sediment delivery.

Water Erosion Prediction Project (WEPP) model

For this project, an analysis and quantitative estimate of sediment reduction resulting from road surfacing near stream crossings was conducted using the Water Erosion Prediction Project (WEPP) model (USDA, Forest Service 2006). A total of 102 crossings were analyzed, with 28 percent (or 29 crossings) being responsible for 94 percent of the sediment. Sediment production from all crossings was estimated at over 45 tons per year, with over 40 tons produced by the 29 worst crossings (data available in planning record). This is a modeled result that is an average for 10 years. It is used here to look at the relative effects to the erosion rates based on different scenarios that occur in the different project alternatives (appendix B of the watershed and fisheries report)

Stream Channel Sediment

Sediment delivery from the Storrie Fire, native surfaced roads, and unstable low-gradient channel reaches is occurring in the project area. This is illustrated by data from stream inventories. Data collected at the sub-watershed scale utilizing the Streamscape Protocol developed by the Lassen National Forest to assess channel conditions, reveals that Butt and Water Creeks have the highest percentage of sediment in pool tails (33 percent and 21 percent respectively (Table 81). These two stream reaches are also located within sub-watersheds, Fannani and Lemm Hollows, which have elevated equivalent roaded acres within RHCAs, as well as high road densities. Butt Creek is a low gradient meadow type channel and would be expected to have higher fine sediment deposition than steeper, confined channels. Butt Creek is also the site of historic grazing activity that has led to past channel instability (though Stream Condition Inventory data shows an increase in stability between 2002 and 2004 Table 81). This is reflected in both the in-stream sediment and channel stability values. The high levels of fine sediment in Water Creek are likely due to high levels of disturbance, including RHCA road densities, within the Lemm Hollows subwatershed as indicated by existing equivalent roaded acres. Where Streamscape data was collected to assess conditions adjacent to proposed RHCA and aspen treatments, both Yellow Creek and Rock Creek had elevated pool tail fines, 24 percent and 15 percent respectively (Table 81). Similar to Butt Creek, this segment of Yellow Creek is a low to moderate gradient channel that has been impacted from historic grazing, timber harvest, and roads. Rock Creek is located within the Grizzly Creek sub-watershed. Moderately high road densities, including those within RHCAs, and past management activities in this sub-watershed have likely contributed to higher than desired amounts of fine grained sediment for this stream type.

Four grazing allotments are located within or partially within the project area. Currently there is only one active allotment with approximately 54 cow/calf pair for a three month grazing season. Surface trampling impacts (soil displacement and compaction) to meadows and streams has been observed in the past on the Butt Creek Allotment. Riparian vegetation is reestablishing on these sites but progress appears to be slow.

Road density and equivalent roaded acres in RHCAs

Table 80 provides information regarding existing conditions using equivalent roaded acres for each project area sub-watershed. Equivalent roaded acres are below the threshold of concern for all sub-watersheds (Table 80). The relatively high equivalent roaded acres in Grizzly Creek and Lemm Hollows is due primarily to three factors: high road density, the Storrie Fire (including fire suppression) that occurred within 27 percent of Grizzly Creek and 17 percent of Lemm Hollows, and subsequent timber salvage (including salvage on private lands). Upper Yellow Creek has had extensive recent timber harvest on private land in the last five years.

A 25 year recovery was assumed for the Storrie Fire. It is likely that wildfire recovery occurs more rapidly; (on the order of 3 – 5 years) therefore equivalent roaded acres estimates in areas burned by the Storrie Fire provide a conservative estimate of disturbance and risk. Sub-watersheds that were wholly or partially burned in the Storrie Fire are Grizzly Creek, Lemm Hollows, and Soda Creek (Table 80)

Table 80. Threshold of concern and pre project equivalent roaded acres

Sub Watershed	Sub-watershed Area (acres)	Threshold of Concern % Equivalent Roaded Acres	Current Equivalent Roaded Acres
Fanani	10,822	16	4.7
Grizzly Creek	7,435	15	10.7
Humbug Valley	5,627	16	3.7
Lemm Hollows	5,233	15	10.8
Marian Creek	7,205	16	3.3
Ruffa	7,801	16	2.7
Shanghai Creek	2,849	16	2.1
Soda Creek	9,175	15	4.0
Soldier Creek	9,795	16	3.9
Upper Yellow Creek	6,981	16	7.4

Source: From Cumulative Watershed Effects Spreadsheet.

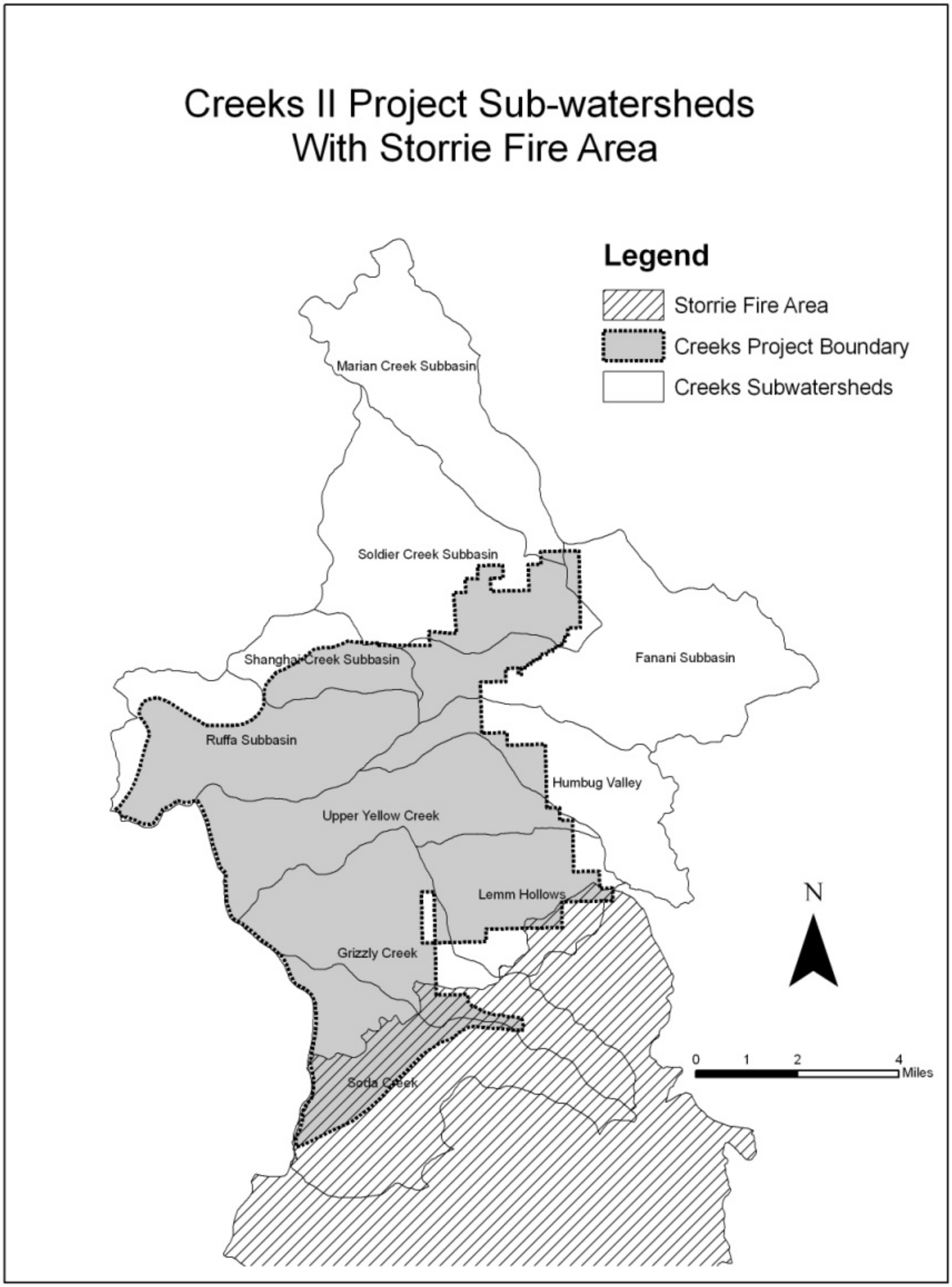


Figure 26. Creeks II sub-watersheds and Storrie Fire

Three measures of near-stream disturbance were calculated for pre -project conditions. These measures include road densities within RHCAs, number of stream crossings per stream mile, and equivalent roaded acres within RHCAs (See Table 87). The Lassen National Forest has no standards for these indicators of watershed risk but an upward trend in these attributes would indicate higher levels of impacts. In general, miles of road within RHCAs and overall disturbance within RHCAs of project area sub-watersheds are moderate. However, currently five of the project affected subwatersheds have RHCA equivalent roaded acres greater than 5 percent, with the greatest amount of near-stream disturbance found in the Lemm Hollows sub-watershed. This is primarily due to near-stream roads and past management activities on private timber land

As mentioned previously, the condition or type of road is not taken into consideration in the equivalent roaded acres model. As such, the road improvements listed above and the surfacing of main roads within the Creeks II project area are not reflected in the current equivalent roaded acres value

Aquatic, Riparian and Wetland Habitat

The project area sub-watersheds contain approximately 290 acres of wetlands on Lassen National Forest Service lands. Extent and distribution of wet meadow habitat within the project area was derived through GIS data depicting California Wildlife Habitat Relations (CWHR). Wet meadow areas include ponds and areas with emergent wetland vegetation, including shrubs. The vast majority of the wetlands in the project area are floodplains adjacent to low to moderate gradient channels in Butt, Yellow, Soldier, LT and Little Grizzly Creeks. The remaining can be characterized as narrow strips of meadow vegetation located along banks of perennial flowing channels. A total of 46 miles of perennial and 98 miles of seasonally flowing stream channels are located on Forest Service Lands within the project subwatersheds. Some insight regarding wetland condition can be inferred from observations and data collected during stream inventories and stream monitoring. The Lassen National Forest utilized two aquatic habitat inventory protocols to describe the existing condition of streams within the project area. These include the R5 Stream Condition Inventory Protocol and Streamscape. Data from these inventories is located in the planning record and summarized in the watershed and fisheries report. The former is an intensive survey of a segment of stream typically less than 1000 meters in length that can be used for pre and post monitoring of land management activities. Streamscape can be classified as an extensive survey of all stream channels within a given sub-watershed allowing for descriptions of broad-scale existing conditions relative to in-stream channels and riparian vegetation. Though habitat attributes collected within each protocol are similar, sample size and intensity are much greater in stream condition inventory. In addition to collecting Streamscape data on a sub-watershed scale, site-specific data was collected within reaches of stream that had proposed RHCA and aspen treatments adjacent to the stream (Table 81).

Table 81. Site specific streamscape inventory data within Creeks II project proposed RHCA and aspen treatment units

		Sub-watershed				
		Grizzly			Shanghai	Upper Yellow
		Stream				
		Sawmill Tom	Rock Creek	LT Creek	Shanghai Creek	Yellow Creek
Year		2008	2008	2008	2008	2008
% gradient		7.6	8.4	6.4	7.1	3.7
LWD (#)		125	123	91	127	38
LWD recruitment	Good	14%	0%	0%	0%	0%
	Fair	86%	100%	100%	80%	14%
	Poor	0	0	0	20	86
# pools		23	24	28	15	7
Residual pool depth		0.39m	0.58m	0.36m	0.53m	0.95m
fine sediment		5.5%	14.5%	11.65%	2.7%	23.6%
shade		70%	65%	79%	61%	9%

Source: Summarized from inventories conducted 2008
LWD: large woody debris, Residual Pool Depth: maximum pool depth minus pool tail depth

Existing conditions within RHCAs

Inventory of RHCAs in and adjacent to stands under consideration for fuels and vegetation treatments were conducted in 2007 to assess stand conditions. In general, this data revealed that stands within RHCAs were exceptionally dense with small diameter trees less than 5 inches d.b.h., and lacked the large diameter (> 24 inches d.b.h) component valuable for healthy riparian and aquatic resources. On average, RHCAs within the project area contain a total of 846 trees per acre. Of these approximately 82 percent were 5 inches d.b.h. or less in size. Trees larger than 20.9 inches d.b.h. comprised < 3 percent of the average trees per acre (Table 82). Fuel concentrations within RHCAs were observed to be moderate to high across the project area, particularly within larger size classes (> 3 inches; Table 82).

Table 82. Summary of RHCA stand conditions by size class within Creeks II project area RHCAs

	Trees/Acre by size class (d.b.h. inches)						Fuel loading (tons acre)	
	<1"	1-4.9	5-10.9	11-20.9	21-30.9	>31	<3"	>3"
Proposed treatment stands (n=41)	488	237	88	57	14	5	4.6	17.4
Range	70-1128	40-493	12-263	22-115	2-26.5	0-14	2-7	6-36
% of total trees	55	27	9	6	2	<1		

Source: Stand inventory data collected in 2007, Almanor RD.

Large wood debris recruitment

Sub-watershed inventory of perennial streams found that the number of large woody debris per mile ranges from 8 pieces (Mudhole Hollow) to 205 pieces (Grizzly Creek) see watershed and fisheries report, planning record. In general, with the exception of Mudhole Hollow, this data characterizes the amount and distribution of large woody debris in project area streams as healthy. Table 81 describes existing conditions at the site scale of where proposed RHCA and aspen treatments may occur. Again, the amount of large woody debris appears to be in good to fair conditions for maintaining healthy aquatic habitats and channel characteristics.

Large wood recruitment can be affected by a number of factors, including topography (sloped vs. meadow), vegetation type, stand condition, and past management. On average, large wood recruitment rated as “Fair” across 57 percent of the project area, followed by “Good” at 36 percent, and finally “Poor” at 8 percent (watershed and fisheries report, planning record). A similar trend was observed within RHCAs that have proposed thinning and aspen enhancements where large wood recruitment was predominately rated as “Fair” (Table 81). The segment of Yellow Creek where large woody debris data was collected within proposed aspen treatment units can be characterized as a low gradient meadow, in which alder is the dominant riparian vegetation and large shade providing conifers are not located adjacent the channel. As a result of existing RHCA stand conditions described above, long-term woody debris recruitment to stream channels would primarily be comprised of small diameter trees.

Channel shade

Stream channel shade in the Creeks II project area was collected using a Solar Pathfinder™ at predetermined locations along inventoried stream reaches. In general, stream channel shade was found to be primarily provided by conifer species along channel banks. However, where conditions are present, specifically perennial flowing channels and springs, riparian hardwoods do play a role in channel shade. Shade measurements conducted during stream condition inventory surveys indicate that the low gradient meadow reaches (Butt Creek and Yellow Creek) have, in general, lower channel shade levels (26 percent) compared to higher gradient reaches (74 percent) (watershed and fisheries report, planning record). This is typical of most meadow reaches where large coniferous vegetation is not located adjacent to the channel, and where smaller riparian hardwoods (alder, willow) are the dominant shade producing vegetation. The location of the stream condition inventory reaches in both Butt and Yellow Creeks are located near the lower portion of their respective sub-watersheds that have been subjected to historic range management as well as large flood events that have resulted in down-cutting of the channel and scouring of stream banks. These events have resulted in decreased distribution and density of riparian hardwoods.

Lower average channel shade values were again observed within Butt Creek (62 percent) and Yellow Creeks (47 percent) at the sub-watershed scale (Streamscape data), when compared to the remainder of streams where sub-watershed scale habitat surveys were conducted (73 percent). In general, channel shade in the project area falls within the natural range of variability for headwater streams on the Lassen National Forest flowing through mixed conifer stands with varying widths of riparian vegetation (e.g. alder, willow, grasses, etc). For those reaches of stream associated with proposed riparian treatments, (RHCA and aspen treatments) stream shade averaged 57 percent. With the exception of Yellow Creek, which had an average stream shade of 9 percent, all shade values for this category were above 60 percent. Again, lower Yellow Creek is within a low gradient, open meadow that has been impacted from historic grazing practices and floods that have altered riparian hardwood distribution and density.

Desired Conditions

The project objectives related to the riparian resource are listed below.

Improve watershed condition (objective 7)

There is a need in the Creeks II project area to make road improvements to reduce sediment delivery to project area streams and to eliminate unneeded roads that are sources of sediment from the transportation system. Recent studies have found that roads are the primary source of sediment in wildland watersheds (MacDonald and Coe 2005). In the project area, sources of accelerated sediment include road crossings, roads located near stream channels, and some roads no longer necessary for long-term management of the area. Studies (Luce and Black 1999) have also found that improved surfacing and drainage on forest roads can substantially reduce sediment delivery originating on roads.

Meet riparian management objectives (objective 8)

A goal of this project is to move watersheds toward desired conditions. These are listed as riparian management objectives. Detailed analysis of each potential effects of the project on each of the eight riparian management objectives is included in appendix D. Scientific Analysis Team guidelines would be implemented (appendix L of the 1999 HFQLG FEIS) for the protection of aquatic habitats, otherwise known as Riparian Habitat Conservation Areas (RHCAs).

RHCAs are employed to protect aquatic habitats and the ecologically important areas adjacent to these habitats. Within RHCAs, areas immediately adjacent to aquatic habitats (inner zones) have different purposes than upslope portions of the RHCAs (outer zones).

The primary objective of the outer zone is to maintain microclimate and protect the inner zone from fire and wind damage. There is a need within the Creeks II project area to provide for continuity of upslope fuel treatments in the outer zone of RHCAs to provide protection for the RHCAs and improve effectiveness of the treatments at larger scales.

Inner zones provide habitat for wildlife, and are important to the process, function and structure of adjacent aquatic habitats. They buffer delivery of upslope flow and sediment to channels, provide shade to channels, moderate air temperatures, provide stability to channel banks, and deliver large wood to stream channels. Surveys of RHCAs in the project area indicate that some of the inner zones have stand characteristics that may jeopardize long term provision of the processes outlined above. Some areas within RHCAs have very high stand densities, high fuel loadings, high density of small diameter trees, and poor species diversity.

RHCA management guidelines include recommended buffer distances for aquatic features, including fens which depend on recruitment of wood to maintain their unique soil and vegetative characteristics. Swales are also afforded protection to prevent increases in delivery of sediment and runoff. Treatments within RHCAs are designed to maintain and enhance riparian conditions, specifically reducing the effects of wildfire and improving both short and long-term function by increasing plant diversity and vigor. All timber management and fire/fuels management proposed within these RHCA buffers must meet the riparian management objectives.

Environmental Consequences

Vegetation Treatments by Alternative

Proposed vegetation treatments within RHCAs in the project area are summarized in Table 83 through Table 85 below. As described in the proposed action for the Creeks II project, treatments within RHCAs included within alternatives 2 and 3 would generally follow the DFPZ or area thin treatment for the adjacent upland stands. Within the inner zone of RHCAs, treatments would be modified through following RHCA specific integrated design features such as canopy cover and upper diameter limit restrictions, such that riparian management objectives would be achieved post implementation.

Table 83. Summary of proposed vegetation treatments within RHCAs in alternatives 2 and 3

Treatment	RHCA Classification	Inner Zone Acres	Outer Zone Acres	Total Proposed Acres
A-E, O	Perennial	148	144	292
	Seasonal	40	47	87
Aspen (F)	Perennial	74	58	132
Aspen (F)	Seasonal	12	10	22

Table 84. Summary of proposed perennial RHCA treatment acres by subwatershed for alternatives 2 and 3

Subwatershed	Inner Zone RHCA Acres By Subwatershed	Proposed Inner Zone RHCA Thinning Treatment Acres	Proposed Inner Zone RHCA Aspen Treatment Acres
Fanani	54	8	0
Grizzly	331	38	0
Lemm Hollows	58	42	0
Ruffa	62	23	42
Shanghai	105	7	0
Upper Yellow	245	8	32
Soda	476	22	0
Humbug Valley	58	0	0
Soldier Creek	93	0	0
Total	**1,840**	**148**	**74**

For those included in alternative 4, the goal is to achieve the fuels objective of reducing ladder fuels by thinning smaller trees from below the forest canopy to increase the average canopy base height and decrease ladder fuels. Following thinning activities, post fuels treatments utilizing a combination of hand and mechanical equipment would occur in the majority of stands in the project area, including those RHCAs identified for treatments. All post treatment fuels activities within RHCAs and require mechanical equipment would be completed utilizing grapple piling equipment to reduce potential impacts to soils resources. Integrated design features, soil quality standards, and best management practices would be consistent for all three action alternatives to maintain resource conditions within riparian areas (see appendix A).

Table 85. Vegetation treatments proposed for alternative 4 within RHCAs

Treatment[a] (upper diameter limit)	Acres
1 (10”)	82
2 (14”)	27
4 (12”)	74
5 (12”)	183
Total of all RHCA vegetation treatments	366

a - Treatments included in Rx 1, 2, 4 pertain to the outer zone of RHCAs only. Rx 5 pertains to the inner zone RHCA.

Road Improvement Activities by Alternative

Table 86. Summary of proposed transportation activities in the Creeks II project area by alternative

Activity	Alt 1	Alt 2	Alt 3	Alt 4
New classified road construction (existing unauthorized route)	0	1.9 miles	1.9 miles	1.91 miles
New temporary road construction then decommission	0	3.6 miles	3.6 miles	1.21 miles
Decommission	0	11.1 miles	11.1 miles	0
Reconstruct existing NFS road	0	2.9 miles	2.9 miles	2.9 miles
Use existing unclassified route as temporary road then decommission	0	5.2 miles	5.2 miles	4.6 miles
Proposed maintenance Level 1(+)	0	1.6 miles	1.6 miles	1.6 miles
Decommission OHV trail	0	1.0 miles	1.0 miles	0
Road Surfacing	0	7.3 miles	7.3 miles	0
Road crossing surfacing	0	72 crossings	72 crossings	0

Water Quality Direct and Indirect Effects

Sediment

Alternative 1

Sediment production from project area watersheds would remain in its present condition. The primary sources of sediment in the project area are existing roads, and road-channel crossings associated with those roads. There would be no change in the density of the road system, the number of road crossings, or the condition of the road crossings. Unlike harvested stands and areas burned by wildfire, roads display virtually no recovery. Large wildfires of high intensity in project area watersheds would increase sediment production substantially over the short (1-5 yr) term if one should occur.

Alternative 2-3

Forest harvest and thinning activities are not expected to measurably increase soil erosion and delivery of sediment to stream channels. All harvest activities would include integrated design features and Forest Service BMPs (USDA Forest Service 2000a) to reduce the risk of on-site erosion.

Mechanical harvest and post fuels treatment activities would be restricted to slopes less than 35 percent, and in the inner zone of RHCAs to slopes less than 20 percent. Soil cover would be maintained in treatment units except where skidtrails, landings and temporary roads were constructed. On these sites, water barring, post treatment decommissioning (landings and temporary roads), and other erosion control measures would minimize the risk of increased erosion. Where soils are not mechanically disturbed, runoff would be expected to infiltrate into the forest floor and increased erosion would not occur. Riparian habitat conservation areas would be in place adjacent to all aquatic habitats. Management within these zones would be designed to meet riparian management objectives (see appendix D).

Where existing stand densities and fuel concentrations do not meet desired conditions alternatives 2 and 3 propose to utilize mechanical equipment to thin some RHCA stands with the goal of minimizing the potential for catastrophic wildfire and improve riparian habitat conditions. In doing so, the risk of soil disturbance and erosion is increased where operations would occur adjacent to stream channels. As mentioned above, RHCA specific integrated design features and soil quality standards that include restrictions on mechanized equipment, slope, soil moisture, and post project ground cover would be implemented. Therefore, the risk of potential sediment transport to aquatic habitats would be minimized. The proposed action would construct 3.6 miles of new temporary roads and reconstruct 5.2 miles of already existing non-system roads as temporary roads. These temporary roads would be constructed to follow the rise and fall of the land to reduce excavation. All temporary roads utilized during the project would be decommissioned as described in the integrated design features for this project. There would be an additional 11.1 miles of system and non-system roads that would be decommissioned. Overall, there would be a net reduction of 15.3 (4 percent) road miles in the project area.

No new road channel crossings would be constructed. Eighteen seasonally flowing stream channel crossings on existing non-system roads would be removed when these roads are decommissioned. Five of these crossings are in the Grizzly Creek sub-watershed; the others are in the Fanani (lower Butt Creek), Shanghai, Lemm Hollows and Soda Creek sub-watersheds. Removal of these crossings may result in a short-term increase in sediment to downstream habitat below these crossings due to the disturbance of decommissioning, but would result in long-term reduction in sediment delivery at the sites and would benefit aquatic habitat.

In the short term, immediate reductions in sediment delivery resulting from road surfacing may be offset to some degree by increases in sediment delivery that result from log hauling and road maintenance, particularly those activities that disturb drainage ditches with connection to stream channels. Luce and

Black (1999) found sediment production (not delivery) increased about seven times as a result of winter haul and road maintenance (especially ditch clearing). Research indicates that surfacing at crossings may reduce delivery of sediment to channels by 10-25 times the existing condition (MacDonald and Coe 2005). As discussed earlier, the WEPP model was used to assess sediment production from road crossings. The same model was used to estimate reductions from proposed transportation treatments. The proposed action would surface approximately 4.7 miles of road with graveled at 72 road/stream crossings and an additional 2.6 miles adjacent to stream channels. Total surfacing would be 7.3 miles. Currently, it is estimated that approximately 45 tons of sediment per year are being produced from crossings in the project area. An estimated 44 percent (25 tons) reduction, of sediment is expected following road surfacing activities. This would result in decrease in sediment production in both the short and long terms.

The time during which roads are used for haul, it is expected sediment reductions from road surface and road surface treatments at crossings would be offset by short-term increases due to road maintenance. However, in the long-term road maintenance activities in alternatives 2 and 3 including decommissioning, surfacing, improvement of crossings and drainage features would decrease sediment delivery to aquatic habitat.

Alternative 4

Although there are fewer acres treated in alternative 4 than alternatives 2 and 3, there would be a higher overall risk for sediment erosion and delivery. There are two primary reasons for this increased risk. The decommissioning of the unneeded roads and OHV trails and their associated stream crossings that are proposed under alternatives 2 and 3 would not occur. These features would continue to erode and pose long term risks to water quality. Additionally, the surfacing of crossings included in alternatives 2 and 3 are not included in this alternative. Since this project would still use all the integrated design features and BMPs and would expand the road network (by 0.5 percent), there may be a small increase in the short-term erosion of sediment, but it is not foreseen to be significantly detrimental to streams in the project area.

Water Yield

Alternative 1

There would be no change to overall water yield or peak flows that are measurable by currently available means. The only exception would be if a large scale high severity wildfire were to occur. These types of events can increase both total water yield and peak flows in the first few seasons. They must burn at a high severity, affect a substantial percentage of the area in a sub-watershed, and remove substantial vegetation and ground cover to create measureable effects.

Alternatives 2-4

Water yield has been shown to increase due to forest management activities in small watersheds (Troendle 1987). These effects can be measurable and important for small watersheds (3rd order and smaller) where clearcutting occurs over 21 - 33 percent or more of the sub-watershed. Because proposed vegetation management and post harvest fuels treatment activities would be limited to less than 26 percent of any project affected subwatershed and group selection harvesting would not exceed more than 2 percent, it is not expected that changes in annual average water yield or peak flows in project watersheds would be detectable from current conditions. Changes to average annual streamflow, instantaneous peak flows, or maximum daily streamflows are generally not detectable in sub-watersheds that are larger than 3rd order stream networks and have less than 21 - 33 percent forest cover removal (King 1994). There is negligible risk of peak flow increases from proposed activities.

The amount of road surface in the project watersheds would be reduced by approximately 40 acres through the proposed action. Roads have compacted surfaces that can contribute runoff, and often include drainage structures (ditches, relief culverts, etc.) that increase the drainage network and concentrate flow. Decommissioning roads should decrease the contribution to peak flows from the restored areas. Timber harvest and fuels reduction activities would not measurably increase soil compaction (Creeks II soils resources report); therefore runoff at the site scale would not be measurably increased. Integrated design features and soil quality standards would be implemented to minimize soil compaction within more sensitive habitats such as RHCAs and areas with greater flow delivery potential.

Water Quality Cumulative Effects

A long-term reduction in sediment delivery is expected as a result of proposed treatments under alternatives 2 and 3. In the short term, sediment delivery would probably be reduced, but off-set by some degree from road maintenance activities where road surface and drainage ditches are disturbed and traffic levels are increased, especially during wet weather.

Road Density and Equivalent Roaded Acres Direct and Indirect Effects

Alternative 1

Subwatershed road densities would not change under the no-action alternative. The existing road network would remain near or above desired conditions, specifically within the Grizzly, Lemm Hollows, and Upper Yellow Creek subwatersheds. Current trends in sediment production and concentrated flows would continue. Subwatershed equivalent roaded acres as well as equivalent roaded acres within RHCAs (Table 87) would also remain similar to existing conditions. Areas of disturbance as a result of past management activities on both private and Lassen National Forest lands would continue to recover. However, we assume private harvesting would continue at current trends.

Alternative 2-3

The proposed action does not represent a major increase in equivalent roaded acres (Table 88). An increase of 3 percent in Grizzly Creek is the largest change. Most of the sub-watersheds show no more than a 2 percent increase.

Table 87. RHCA road densities and RHCA equivalent roaded acres (ERA) for the current condition and alternatives 2-3

Sub-watershed	RHCA Road Density (miles/sq. mile)		RHCA ERA (%)		Stream Crossings / Mile of stream	
	Current	Alt 2-3	Current	Alt 2-3	Current	Alt 2-3
Fanani	5.3	5.1	10.6	11.1	1.5	1.3
Grizzly Creek	6.2	5.6	10.1	10.9	1.9	1.8
Humbug Valley	4.2	4.2	4.1	4.3	1.5	1.5
Lemm Hollows	6.8	6.5	11.5	11.9	1.7	1.6
Marian Creek	10	10	7.4	7.4	2.7	2.7
Ruffa	4	3.9	2.8	5.3	1.2	1.1
Shanghai Creek	6.5	6.1	4.0	4.2	2	1.9
Soda Creek	1.4	1.3	2.7	3.0	0.9	0.9
Soldier Creek	4.9	4.8	7.8	7.8	1	1
Upper Yellow Creek	4.8	4.6	4.4	6.1	1.5	1.3

Source: Almanor RD GIS road and watershed layers, cumulative effects spreadsheets

The project would construct no new roads in RHCAs; therefore, road density in the RHCAs would not increase. Due to decommissioning, the amount of road within RHCAs and the number of stream crossings would slightly decrease. This would decrease the risk of sediment and flow delivery from road surfaces. Mechanized equipment is prohibited or very restricted in the inner zone, and new skid trail and landing construction is prohibited within the entire RHCA. As the actions in the RHCAs meet riparian management objectives (see discussion in appendix D) and result in improved conditions in the long-term, the risk of negative effects from these actions is rated as low.

There are several actions that are meant to reduce impacts from vegetation management and will improve sub-watershed conditions in the long-term. There would be a reduction of 25 tons of sediment following improvement of approximately 70 crossings by adding or restoring road surface material; of which approximately 25 crossings and/or sites are in the Grizzly Creek subwatershed. Because a substantial amount of existing chronic sediment delivery is associated with crossings, the result of these treatments would be an estimated annual reduction of 25 tons in the project area watersheds. Surfacing does not change the equivalent roaded acre value because the model treats all roads the same. Road density would be reduced slightly in the project area as a result of decommissioning (Table 87). Overall, the net reduction in roads within the project analysis area is 15.3 miles or 4 percent. The amount of decommissioning is low relative to the amount of road, so road densities at the sub-watershed scale remain essentially unchanged, and this action does not significantly affect the cumulative effects indicators. Nevertheless, much of the decommissioning is occurring in RHCAs and will have long-term benefits to the sub-watersheds (Table 87). The same result is true of road crossings. The number of crossings would be reduced by twenty but relative to the high number of crossings (over 100) in the project area the reduction does not appreciably reduce risk at the sub-watershed scale.

Table 88. Threshold of concern equivalent roaded acres (ERAs) and pre project, post project, and 5 year projection

Sub Watershed	Threshold of Concern ERA %	Current ERA %	Alt 2-3 ERA %	ERA + 5 years if PA not implemented	ERA + 5 years if PA implemented
Fanani	16	4.7	5.2	5.0	5.5
Grizzly Creek	15	10.7	13.7	9.2	11.8
Humbug Valley	16	3.7	5.3	3.8	5.1
Lemm Hollows	15	10.8	13.2	10.0	12.0
Marian Creek	16	3.3	3.5	3.3	3.4
Ruffa	16	2.7	4.3	2.4	2.3
Shanghai Creek	16	2.1	3.3	2.0.	3.0
Soda Creek	15	4.0	4.9	3.4	4.1
Soldier Creek	16	3.9	4.4	5.4	5.8
Upper Yellow Creek	16	7.4	9.4	6.3	8.0

Source: Almanor RD GIS road and watershed layers, cumulative effects spreadsheets and PORFA.

Alternative 4

RHCA equivalent roaded acres would be the same as alternatives 2 and 3 except where aspen treatments were eliminated from alternative 4. In those areas the equivalent roaded acres would be less. The positive trends in stream crossings and near stream road density would not exist in alternative 4 because road decommissioning would not occur.

Road Density and Equivalent Roaded Acre Cumulative Effects

Under alternative 1 road density and number of road crossings (see Table 87) within RHCAs would remain unchanged. Under alternatives 2 and 3, the proposed treatments would not approach the equivalent roaded acre threshold of concern for the Grizzly Greek, Lemm Hollows, and Upper Yellow Creek sub-watersheds, but the moderately high equivalent roaded acre values are a concern and a signal that more watershed restoration activities may be needed in the future. Additional road improvements (surfacing and drainage) and decommissioning would reduce the risk associated with the high equivalent roaded acre value.

Cumulative effects for alternative 4 would be very similar to alternatives 2 and 3. Overall, there are 20 percent less acres of treatments, so the increase in equivalent roaded acre for any sub-watershed would be about 20 percent less. For instance, Grizzly Creek would go up from 10.7 to 13.7 under alternatives 2 and 3, and for 4 it would go up to 13.1.

Overall there is a negligible risk of increased cumulative effects from this alternative although this alternative poses greater risk than the other 3 alternatives.

RHCA habitat attributes: stand composition and large wood recruitment

Direct and Indirect Effects

Alternative 1

No direct changes to stand composition would occur under this alternative as no project would occur. Stand conditions that are currently dominated by small diameter shade tolerant conifer species would continue proliferate resulting in increased stand density and decreased species heterogeneity. RHCAs would continue to be susceptible to high severity wildfire effects. As stated in the fire and fuels report for the project, if a wildfire were to occur, RHCAs are likely to burn as a passive crown fire which may result in a large proportion of these stands loosing the ability to produce large woody debris in the long-term. It is likely that with existing fuel conditions, that a wildfire would result in more areas with high severity than if fuel loading were reduced. Furthermore, although large wood recruitment potential would likely increase due to density related mortality, the diameter of trees recruited to stream channel habitats would likely decrease over the long-term.

Alternatives 2-3

Thinning treatments within RHCAs were designed to reduce stand densities (change in trees per acre); increase average tree diameter throughout the stand; and reduce existing ladder and surface fuels. Table 89 summarizes expected stand conditions following implementation of vegetation management activities within inner zone RHCAs that would result in stands more closely resembling historic conditions.

Table 89. Summary of stand conditions within RHCAs following vegetation management activities

Measurement Indicator	Existing Condition	Post Implementation Condition
Trees Per Acre (avg)	846	227
Diameter (avg)	7.1	13.1
Canopy Base Height (ft)	4	10
Surface Fuels (tons/acre)	17.1	6.4

In general, stands would follow a thin from below treatment that would primarily focus on removal of small diameter ladder fuels. Following treatment, it is anticipated that the average trees per acre within RHCAs would range from 150 to 300, and average 227. To achieve a forest health component, some larger diameter trees (<24 inches d.b.h.) may be harvested to open the canopy, allow increased sunlight to the forest floor, and improve growing potential for residual shade intolerant conifer and riparian species. Furthermore, with expected reductions in surface fuels and ladder fuels (increased canopy base height) in combination with reduced stand densities, the risk of high intensity wildfire would be decreased.

Large wood is important to the aquatic environment because it routes and stores sediment provides habitat complexity and acts as a substrate for biological activity. Stream habitat surveys of the streams within the project area showed the majority of in-channel wood and large wood recruitment is rated as "fair" to "good" (see Table 81). Because thinning of non-riparian hardwood species would occur within 188 acres and aspen enhancement which includes conifer removal within 86 acres of inner zone RHCAs, recruitment of woody material is expected to decrease in the short-term. In the short term, harvested trees in the inner zone of RHCAs would not be available for recruitment to stream channels. In the long term, treated stands would produce larger diameter trees available for recruitment into project area stream channels (Table 89). Therefore, the likely result is a possible reduction in the number of trees recruited to channels, followed by a long-term increase in the volume of recruited material. This generalized response would differ in areas immediately adjacent to channels. The design criteria to retain trees that contribute to stream bank stability would maintain large woody debris recruitment. Since in-channel large woody debris comes primarily from trees on or near channel banks, the overall effect on large woody debris recruitment would be minimal.

Alternative 4

Activities proposed within RHCAs intended to reduce potential for high intensity wildfire through treatment of surface and ladder fuels would result in changes in large woody debris recruitment to stream channels. Within approximately 371 acres of RHCAs, trees up to 14 inches d.b.h. would be removed to achieve the fuels objective which includes desired flame lengths of less than four feet, canopy base heights greater than 20 feet, and surface fuel loadings less than five tons per acre of 0-3 inches d.b.h. and 8-10 tons per acre of > 3 inches d.b.h. As a result, it is anticipated that stand conditions would become less dense, average mean diameter would slightly increase, and surface and ladder fuel concentrations would decrease (Table 90).

Table 90. Summary of effects resulting from alternative 4 on stand conditions within RHCAs

Effects Measurement	Pre Project Conditions	Post Project Conditions
Average Diameter	6.9	7.4
Average Trees Per Acre	846	98
Average Canopy Base Height (ft)	4	19
Average Surface Fuels (tons/acre)	17	5

Although fuels objectives and some stand characteristics would be improved through this alternative, valuable riparian objectives may not be met. Currently, distribution of trees throughout diameter size classes is heavily skewed with approximately 91 percent of all trees less than 12 inches d.b.h. This alternative would, on average, remove approximately 97 percent of all trees less than 12 inches d.b.h. As a result, vertical stand heterogeneity and future large wood recruitment to stream habitats would be decreased in short and long terms.

Cumulative Effects

The cumulative effect analysis area for the Creeks II project includes the ten sub-watersheds outlined above.

As previously mentioned, a cumulative effect can result from the incremental impact of the action when added to the effects of past, present, and reasonably foreseeable actions. Ongoing and future activities on National Forest System and private lands with the potential for impacts to RHCAs in the project area include vegetation management projects which include actions within riparian areas, wildfire, and wildfire suppression. Riparian areas throughout the project area have been affected by past management activities including timber harvest (public and private lands), wildfire suppression, and grazing. In general, those RHCAs located on National Forest System lands have had minimal vegetation management activities implemented over the last twenty years. As such, these areas are currently heavily overstocked, dominated by small diameter trees, and are at risk of high intensity crown fire.

Under the no-action alternative there is no actions in which to add, thus in the short-term there are no direct or indirect effects to RHCA stand conditions, large woody debris recruitment, or stream channel shade. In the long-term, it is anticipated that RHCAs would continue to trend towards a high risk for wildfire, increased stand density, and poor stand health.

Under activities implemented through alternative 2 and alternative 3, overall, the risk of high intensity wildfire would be reduced for up to 20 years through reductions in average stand density, and surface and ladder fuels. Furthermore, as stated in the silviculture report for the project, forest health would be improved through understory thinning activities that would result in larger trees available for recruitment to stream channels in the long-term. Treatment prescriptions in RHCAs were developed to ensure that sufficient stand density remains following implementation, such that adequate density related mortality could continue to provide large woody debris in the short and long-terms. In summary, the expected cumulative effects of implementing alternative 2 or alternative 3 would include improved overall forest stand health and structure within RHCAs, decreased risk of high intensity wildfire, and improved large woody debris recruitment in the long-term over the current conditions. Though these cumulative effects would be minimal due to that only four percent of the RHCAs located on National Forest System and private lands would be treated through vegetation management.

Although implementation of alternative 4 would result in achieving the desired fuels objective of reducing the risk of high intensity wildfire and providing a safe zone for fire suppression, post implementation stand structure and large wood recruitment potential would be affected in the short and long-terms. However, because alternative 4 would only treat approximately four percent of all RHCAs on contained within both National Forest System and private lands within the project affected subwatersheds, these impacts would not likely contribute to negative cumulative effects at the subwatershed scale.

RHCA habitat attributes: channel shade

Direct and Indirect Effects

Alternative 1

No changes in either shading of aquatic habitats or water temperature would result because there would be no treatment of vegetation that provides shade. These conditions could change if a wildfire of high intensity were to kill vegetation in riparian areas. Barring wildfires of high severity occurring in project area watersheds, current water yield conditions would be maintained with very little change in the short or long term. Vegetation in previously harvested stands and areas burned by the Storrie Fire would continue to mature. Evapotranspiration in these sites would increase, with resulting decreases in soil moisture and slight decreases in water yield, though not likely measurable. If additional high intensity wildfires were to occur across large percentages of project area subwatershed, changes in water temperature, stream channel shade, large woody debris recruitment, and sediment would likely occur.

Alternatives 2-4

Vegetation growing within close proximity of stream channels plays an important role in regulating channel shade, air temperature, and relative humidity. Removing vegetation within RHCAs would result in a potential for increased air and stream temperatures. The distance from stream channels where vegetation has the greatest influence on these attributes ranges from 50 to 197 feet from channel edge (Moore et al. 2005). Analysis of changes to stream temperature and shade focuses on those proposed treatments located within the inner zone of perennial RHCAs (150 ft from channel edge); the area most responsible for providing stream shade.

Within the Creeks II project area, there are approximately 1,840 acres of inner zone RHCA adjacent to perennial flowing stream channels. Of these, approximately 222 acres are proposed for either thinning or aspen enhancement (Table 83 and Table 85).

To meet the objective of reducing the potential for high intensity wildfire and improve conditions of riparian dependant species within RHCAs, silvicultural treatments call for reducing stand densities and ladder fuels in 148 (8 percent of) acres of perennial inner zone RHCA. As a result, it is anticipated that in the short-term, channel shade would be reduced. Ambient air temperatures within RHCAs may also increase due to increased solar input through the opened forest canopy, which studies have shown can influence water temperatures (Chan et al. 2005). Treatment within RHCAs would generally follow a thin from below treatment that would focus on removal of smaller diameter trees and ladder fuels. To achieve a forest health component, some larger diameter trees (<24 inches d.b.h.) may be harvested to open the canopy, allow increased sunlight to the forest floor, and improve growing potential for residual shade intolerant conifer and riparian species.

Under alternatives 2-3, average canopy cover across all treated RHCA stands would be approximately 43 percent (Table 89). Average residual canopy cover would be retained at or above 40 percent except in stands with initial canopy cover less than 40 percent or stands with mostly 6 inch d.b.h. or less size trees. Most stands with 40 percent canopy cover or less have high densities of trees less than 6 inch d.b.h. and would retain approximately 39 - 95 percent of existing canopy cover. Stands with existing canopy cover at 60 percent or greater would retain 50 percent canopy cover with the exception of stands with mostly 6 inch d.b.h. or less size trees.

Under alternative 4 on average, canopy cover within treated RHCAs would be reduced to an average of 37 percent post implementation. Treatment within RHCAs would include the removal of approximately 97 percent of all trees less than 12 inches d.b.h. Overall, it is anticipated that canopy cover would be reduced by 19 percent within treated RHCAs in the project area (Table 89).

Integrated design features to be implemented to minimize impacts to channel shade include:

- No trees over 8 inches d.b.h. would be removed within ten feet of a channel.
- No trees greater than 24 inches d.b.h. would be removed.
- No riparian hardwood species (alder, willow, aspen, and cottonwood) would be removed.

It is estimated that following thinning activities, stream shade would be reduced on the stand scale by approximately 10 percent. Across the entire project area, it is proposed to thin approximately 8 percent of the inner zone RHCA acres adjacent to perennial streams.

Proposed aspen enhancement would occur within approximately 74 acres (4 percent) of perennial inner zone RHCAs in the project area (Table 85). Aspen enhancement treatments require a much greater reduction in canopy where aspen are dominantly shaded by conifer. It is expected that canopy cover (outside of stream cover) would be reduced to 5 percent to 20 percent following thinning of conifers in the stand. Where conifers would be removed in close proximity to stream channels, a large reduction in channel shade may occur. At the site scale, this may cause short-term (0 to 5 years) increases in solar input to channels. In the long-term it is expected that lost channel shade produced by conifers as a result of thinning would be replaced by regenerated aspen and other riparian hardwood species. Recent monitoring indicated that stream shade decreased as expected along South Fork Bailey Creek and Pine Creek following implementation of two HFQLG aspen enhancement projects (Cabin Project; Hat Creek

RD and Mckenzie Project; Eagle Lake RD, respectively). Stream channel shade decreased approximately 11 percent within South Fork Bailey Creek, and 7 percent within Pine Creek (HFQLG Stream Monitoring Annual Summaries from 2007 and 2008). Water temperature data collected at these sites indicated there was no increase in water temperature compared to pre-project conditions.

In summary, the risk of indirect effects to water temperature and channel shade under alternatives 2-4 is considered low. Under alternatives 2-3, the proposed treatments within inner zone RHCAs were developed to improve conditions adjacent to streams and within sensitive riparian areas to historical conditions, trend towards a more fire resilient ecosystem, and increase the proportion of channel shade provided by hardwoods. However, thinning and aspen enhancement actions proposed within inner zone RHCAs would result in short-term decreases in channel shade at the stand scale. Under all action alternatives (2-4) due to the limited area proposed for harvest, and because no trees larger than 8 inches d.b.h. would be removed within ten feet of any defined stream channel, decreased channel shade would not be expected to result in significant increased water temperatures on the sub-watershed or project scale.

Cumulative Effects

Ongoing and future projects that have the greatest potential for impacts to stream channel shade include vegetation management activities on National Forest System and private lands, and wildfire. As described above, due to the high stand density and dominance of small diameter trees within RHCAs, stream channel shade conditions are currently properly functioning as a result of existing conifer vegetation adjacent to stream channels that are providing sufficient channel cover.

Under alternative 1, no vegetation management actions would occur, thus there would be no direct or indirect effects to channel shade. However, if a wildfire were to occur within RHCAs at a high enough intensity that resulted in extensive mortality, channel shade may be reduced to the point that measurable water temperature increases could occur.

Under alternative 2 and alternative 3, a low risk of direct and indirect effects to stream channel shade would occur as a result of removal of conifer trees within the inner zone of perennial RHCAs. However, through implementation of RHCA specific integrated design features which include maintaining all trees greater than 8 inches d.b.h growing within ten feet of stream channels, the risk of increased water temperature as a result of canopy removal would be low. Reductions in existing stream channel shade are expected to be for the short-tem. Furthermore, alternative 2 and alternative 3 would treat approximately 7 percent of the total perennial stream RHCA acres contained on National Forest System and public lands. Therefore, due to the low risk of indirect effects to water temperature, and that only a small percentage of the perennial inner zone acres are proposed for treatment, alternative 2 and alternative 3 pose a low risk of effects at the cumulative effects scale.

Aquatic Sensitive, Endangered and Threatened Species

This analysis documents potential effects from this project activities on two Forest Service Region 5 amphibian species (see Table 91). Currently, there are no sensitive aquatic species presently occurring within the project area. Although potential suitable habitat for Cascades frogs and Sierra Nevada yellow-legged frogs exists within the project area, no known occurrences of these species were located during surveys.

The aquatic species biological evaluation/assessment evaluation (planning record) provides additional detail on all species considered for analysis but dropped due to lack of habitat. No other currently listed Forest Service sensitive aquatic species are known or have potential habitat within the project area. No threatened or endangered aquatic species occur within the project area, and they will not be considered further in this analysis.

Table 91 lists aquatic TES species that may occur on the Lassen National Forest. The table includes the rationale for extent of consideration of each species for analysis within the Creeks II project.

Table 91. Aquatic TES species - Lassen National Forest

Species	Status	Species or Habitat Present	Consideration in this document
Central Valley steelhead ESU (*Oncorhynchus mykiss*)	Threatened	No	Not Considered: The North Fork Feather River provided historic habitat for Spring Run Salmon and steelhead. Construction of Lake Almanor in the early 1900s, and subsequent construction of hydroelectric facilities along the North Fork Feather River have blocked access of this species which now moves upstream only as far as the Oroville hatchery.
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	No	Not Considered: Rationale as above for steelhead
California red-legged frog (*Rana aurora draytonii*)	**Threatened**	**Yes**	**Based on the compilation of historical distribution information for the California red-legged frog, including review of museum specimens, no sightings of this species have been documented in or near the project area, or on the Lassen National Forest. As directed by the 1999 HFQLG ROD, a site assessment for CRLF was prepared for this project. The assessment concluded the suitable habitat within the project area had been surveyed and did not warrant survey of additional areas.**
Shasta Crayfish (*Pacifastacus fortis*)	Endangered	No	Not Considered: The project area is outside of the known historical range of this species.
Foothill yellow-legged frog (*Rana boylii*)	FS Sensitive	No	Not Considered: The upper elevational range of the foothill yellow-legged frog is considered 4500 feet. The nearest current known population of this species is located near Hole-in-the-Ground on Mill Creek, about 8 miles northwest of the nearest activity area, at an elevation of about 4200 feet. The lack of historical sightings or museum records of this species supports the conclusion that the project area lies outside their range.
Sierra Nevada yellow-legged frog (*Rana sierrae*)	**FS Sensitive**	**Yes**	**Considered in this document because they are known to occur, and have occurred historically in the Upper North Fork Feather River watershed and near the project.**
Cascades frog (*Rana cascadae*)	**FS Sensitive**	**Yes**	**Considered in this document because they are known to occur, and have occurred historically in the Upper North Fork Feather River watershed and near the project.**
Northwestern pond turtle (*Clemmys marmorata marmorata*)	FS Sensitive	No	Not Considered: Addressed in the wildlife BE
California floater (*Anodonta Californians*)	FS Sensitive	No	Not Considered: Aquatic conditions within the project area do not meet one or more of known habitat conditions suitable for this species: large spring or slow stream, lake, mud-sand substrate, low or mid-elevation.
Great Basin Rams-horn (*Helisoma newberryi newberryi*)	FS Sensitive	No	Not Considered: The project area is not within the known historical range of these species.
Scalloped Juga (*Juga occata*)	FS Sensitive	No	Not Considered: The project area is not within the known historical range of these species.

Species	Status	Species or Habitat Present	Consideration in this document
Topaz Juga (*Juga acutifilosa*)	FS Sensitive	No	Not Considered: The project area is not within the known historical range of these species.
Montane Peaclam (*Pisidium ultramontanum*)	FS Sensitive	No	Not Considered: The project area is not within the known historical range of these species.
Nugget pebblesnail (*Fluminicola seminalis*)	FS Sensitive	No	Not Considered: The project area is outside of the known historical range of this species.
Eagle Lake Rainbow trout (*Oncorhynchus mykiss aquilarum*)	FS Sensitive	No	Not Considered: The project is outside the historical range of the species.
Central Valley fall/late-fall-run Chinook salmon ESUs (*Oncorhynchus tshawytscha*)	FS Sensitive	No	Not Considered: Rational as above for steelhead and Spring-run Chinook salmon

Of the species listed in Table 91, only Cascades frog and Sierra Nevada yellow-legged frog are considered in this document because they are known to have occurred historically in the Upper North Fork Feather River watershed and in or near the project area. The other Forest Service sensitive and federally listed species are not addressed further in this document.

Affected Environment

Cascades Frogs (*Rana cascadae*)

The Cascades frog occurs in the Cascades range of Washington, Oregon, and northern California. In California, Cascades frog distribution is associated with montane and sub-alpine landscapes (Garwood and Welsh 2007). Historically, the Cascades frog was distributed in California from the Shasta-Trinity region eastward toward the Modoc Plateau and southward to the Lassen region and upper Feather River system (Jennings and Hayes 1994). The known elevational range of the Cascades frog in California extends from 760 feet to 8250 feet (ibid), but all current populations, and historic records available from museums for areas within the Lassen National Forest boundary, are all above approximately 4500 feet in elevation (USDA Forest Service 2010b).

The Cascades frog is a mountain frog most common in small pools adjacent to streams flowing through subalpine meadows. They also inhabit fens, seasonally-flooded, forested swamps, small lakes, ponds, and marshy areas adjacent to streams (Leonard et al. 1993). In Oregon, Cascades frogs are abundant in ephemeral ponds that transition into meadows by the end of summer (D. Olson 1994, personal communications), but they probably cannot survive in ephemeral situations where at least some of the substrate does not remain saturated (Jennings and Hayes 1994).

Cascade frog distribution in proximity to the Creeks II project

The Creeks II project is located within the greater Yellow and Butt Creek watersheds which ultimately drain to the North Fork Feather River. Historically, Cascades frogs appear to have been more abundant and widely distributed. Museum records dating from 1924 to 1971 document the presence of Cascades frogs within the project area at Little Grizzly Creek Valley, Butt Creek and Yellow Creek. Recent, repeated surveys of these sites (Little Grizzly Valley by Fellers and CAS, Yellow Creek by Fellers, CAS and Forest Service) have been negative for Cascades frogs.

No populations of Cascades frogs are known to presently exist within the Creeks II project area. There has been one incidental observations of a Cascades frog from Butt Creek in 1996 made during a stream survey. Repeated amphibian surveys of the area have not confirmed the incidental sightings. Cascades frog is present to the west of the project area in Willow and Colby Creeks which drain to Butte Creek and then the Sacramento River and north of the project area in Carter Creek, which drains to Deer Creek then the Sacramento River. It is also found in Warner Creek, about 15 linear miles north of the Creeks II project, which drains into Lake Almanor and then down the East Fork North Feather River.

Extant populations of Cascades frogs on the Lassen National Forest (Carter Creek, Colby Creek, Screwdriver Creek, and Warner Creek) occupy wetland, boggy type habitat in meadows with standing water, though Cascades frogs have also been found elsewhere in stream environments. Therefore, both lentic and lotic habitats within the project area are considered suitable.

Sierra Nevada yellow-legged frog (*Rana sierrae*)

Recent research conducted by Vredenburg et al. (2007) suggests that Sierra Nevada yellow-legged frog populations found in the Sierra Nevada, and southern California can be genetically and morphologically separated into two distinct species. This study finds the species *Rana muscosa* to be located in the Sierra Nevada below 36.7°N latitude, and in southern California. The species *Rana sierrae* is found north of this latitude, in which the Lassen National Forest is located. From this it is assumed that all historical and current populations occurring on the Lassen National Forest were of the northern species *Rana sierrae*, and this document will use that species name for the remainder of this report.

Sierra Nevada yellow-legged frogs are endemic to the Sierra Nevada from 4,500 feet to over 12,000 feet elevation (Jennings and Hayes 1994). Sierra Nevada yellow-legged frogs are highly associated with water bodies throughout all life history stages (eggs, tadpoles, and adults). They prefer well illuminated, sloping banks of meadow streams, riverbanks, isolated pools, and lake borders with vegetation that is continuous to the water's edge (Zeiner et al. 1988). They appear to be absent from very small creeks, preferring open stream and lake margins that gently slope up to a depth of 12-20 inches. Suitable breeding habitat for mountain yellow-legged frogs is considered to be low gradient (up to 4 percent) perennial streams and lakes and ponds. Streams in this category generally have the potential for deep pools and undercut banks which provide the habitat requirements of this frog.

Similar to other Ranid frog species, the Sierra Nevada yellow-legged frog populations in Northern California appear to be declining. Vredenburg et al (2007) reported that of the 225 historic (1899-1994) populations of Sierra Nevada yellow-legged frog, 146 are now extinct. Likely causes of this decline include introduction of non-native trout species, prevalence of chytridiomycosis, habitat loss, and air pollution.

Sierra Nevada yellow-legged frog distribution in proximity to the Creeks II project

No populations of Sierra Nevada yellow-legged frogs are known to presently exist within the Creeks II project area. There is presently one known population of Sierra Nevada yellow-legged frog on the Lassen National Forest. This population was recently confirmed by USDA Forest Service crews (2005) at Oliver Lake, approximately 8 miles south of the project area (USDA Forest Service Sierra Nevada Amphibian Monitoring Program (SNAMPH) database). The other nearest populations are on the Plumas National Forest, from Bean Creek approximately 12 miles SE of the project area and the Boulder Creek watershed more than 25 miles east of the project area.

Habitat Description in the Creeks II project area

Potential habitat for Cascades frogs and Sierra Nevada yellow-legged frog in the Creeks II project area is primarily associated perennial stream channels, springs, wet meadows, and fen habitat within the nine subwatersheds listed in Table 96. Within the Creeks II project area there are approximately 46 miles of perennial streams, 290 acres of wet meadow, and 126 acres of fen habitat (Table 92).

Table 92. Summary of potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs in the Creeks II project area subwatersheds

Subwatershed	Perennial Streams (miles)	Meadows (acres)	Fens (acres)
Fanani	2	32	<1
Grizzly Creek	8	69	12
Humbug Valley	2	50	32
Lemm Hollows	2	3	4
Ruffa	7	40	38
Shanghai Creek	3	2	1
Soda Creek	14	24	2
Upper Yellow	5	19	2
Soldier Creek	3	52	0
Total Acres	46	291	91

For a detailed description of existing potential suitable habitat conditions for Cascades and Sierra Nevada yellow-legged frogs, refer to the watershed and fisheries section of the EIS (pg. 163) and the Creeks II aquatic biological evaluation/biological assessment (planning record).

Alternative 1: No-action

Direct Effects

Under the no-action alternative, no project activities would occur. Therefore, there would be no direct effects to either Cascades frogs or Sierra Nevada yellow-legged frogs. Neither of these species is known to presently occur in the project area. There will be no project activities occurring within potential suitable habitat for these species, and there will be no disturbance to potential suitable habitat including stream channels, springs, or other aquatic habitats.

Indirect Effects

Under the no-action alternative, roads within RHCAs that are currently contributing sediment to streams would not be improved; therefore, sediment would continue to impact potential suitable habitat within perennial stream channels at the existing rate. Cascades frog and Sierra Nevada yellow-legged frog habitat would remain in its current condition and trend.

Furthermore, the risk for large-scale wildfire may continue to rise as stands become denser and ladder fuels naturally increase. The potential effects of high-intensity, large wildfires to the aquatic environment include an increase in sediment and ash, loss of streamside and riparian vegetation, and loss of large woody debris. These changes could negatively alter habitat elements such as water temperature, substrate, large wood, riparian vegetation, and streambank stability. Fast, high intensity wildfire could also cause direct mortality to individuals.

Cumulative Effects

As the no-action alternative would preclude any management activities, there would be no short term direct or indirect effects to potential suitable habitat. In the long term, it could be assumed that fire exclusion within and adjacent to potential suitable habitat for Cascades frog and Sierra Nevada yellow-legged frog may result in continued conifer encroachment and further contributing to overall loss of habitat in the project area.

Alternative 2 and Alternative 3

Direct Effects

The likelihood of direct effects to Cascades and Sierra Nevada yellow-legged frogs with implementation alternatives 2 and 3 is low, as these species are not known to presently occur in the project area. However, if Cascades frog or Sierra Nevada yellow-legged frog are located within the project area and have gone undetected, the highest risk of direct effects would occur as a result of proposed treatments located within inner zone RHCAs adjacent to perennial streams and wet meadows. In these areas, mechanical equipment would be utilized to implement thinning and aspen enhancement activities within inner zones adjacent to perennial streams (222) acres and wet meadows (approximately 72 acres) Table 93. There would be no entry of mechanical equipment within designated fen habitat or direct disturbance of perennial stream channels. If frogs where present at the time of implementation, there would be a risk of individual mortality through contact with mechanical equipment or felled logs. The risk of direct effects would be minimized through RHCA specific integrated design features including equipment exclusion zones extending 25 feet from all stream channels, and soil moisture restrictions that would limit both spatial and temporal disturbance in those areas that likely provide potential suitable habitat.

Table 93. Summary of proposed vegetation management activities within or adjacent to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs in the Creeks II project area subwatersheds

Subwatershed	Vegetation Treatments within Perennial Stream Inner Zone RHCAs		Vegetation Treatment within Wet Meadow Habitat (includes RHCA inner zone)	
	Proposed Treatment		Proposed Treatment	
	Thinning	Aspen	Thinning	Aspen
Fanani	8	0	29	0
Grizzly Creek	38	0	3	0
Humbug Valley	0	0	0	0
Lemm Hollows	42	0	0	0
Ruffa	23	42	9	26
Shanghai Creek	7	0	0	0
Soda Creek	22	0	0	0
Upper Yellow	8	32	4	1
Soldier Creek	0	0	0	0
Total Acres	148	74	45	27

Prescribed burning would also occur within RHCAs and could affect individuals crossing through upland habitats if Cascades frog or Sierra Nevada yellow-legged frog populations have gone undetected and burning was conducting during periods when the species are moving from or to aquatic habitats. However, because these units would be burned during the fall months when Cascades frogs and Sierra Nevada yellow-legged frog would likely not be located within upland habitat, the risk of direct effects is negligible.

Potential chemical contamination to Cascades and Sierra Nevada yellow-legged frog from borate application is not expected to occur because the species in not believed to occur in the project area and application in the inner zones of RHCAs surrounding potential suitable habitat is negligible. Borate would not be applied to within 25 feet of any standing water, or within any aspen enhancement units. If individual frogs came in contact with borax on or near treated stumps, sickness or mortality could occur. The likelihood of this is rated as negligible due to minimal treatments in the inner zones of RHCAs surrounding potential suitable habitat.

Indirect Effects

Designation of Riparian Habitat Conservation Areas (RHCAs) would provide a high level of aquatic and riparian protection. These areas consist of those portions of the watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affects standing and flowing waterbodies such as lakes and ponds, wetlands, streams and stream processes. Potentially suitable habitat for Cascades frogs and Sierra Nevada yellow-legged frogs would be indirectly benefited by designation of the RHCAs as a whole. Where certain actions are proposed within RHCAs, however, there is potential for habitat to be indirectly (positively and/or negatively) affected. While important habitat elements may not be fully understood for these species, potential indirect effects to habitat are likely to be associated with the following changes.

Air and water temperature

Canopy removal as a result of silvicultural treatments in RHCAs, could change the temperature regime (water and ambient air) in potential suitable habitats. Changes in water and air temperatures could affect survival rates, growth rates and reproductive success.

Sediment regime

As a result of changes in hillslope runoff, accelerated erosion, and peak flows, increased sediment could impair water quality and affect survival and growth rates of Cascades, and Sierra Nevada yellow-legged frogs.

Air Temperature/ Water Shade

Reduction of shade could result in potential increases in water and ambient air temperatures. Temperature changes could affect natural growth and development processes of Cascades frog and Sierra Nevada yellow-legged frog. Vegetation within the inner zone of RHCAs are generally the primary contributor of shade for potential suitable habitat within and adjacent to stream channels and wet meadows. Within the Creeks II project area, there are approximately 2,889 acres of inner zone RHCAs on National Forest System lands. Of which 1,840 acres are associated with perennial water bodies. In total, approximately 294 acres are proposed for either RHCA thinning (193 acres) or aspen enhancement (101 acres) within or adjacent to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs (Table 93).

To meet the objective of reducing the potential for high intensity wildfire and improve conditions of riparian dependant species within RHCAs, silvicultural prescriptions call for reducing stand densities and ladder fuels. As a result, it is anticipated that in the short-term, shade cover within potential suitable habitat shade would be reduced. Ambient air temperatures within RHCAs may also increase due to increased solar input through the opened forest canopy, which studies have shown can influence water temperatures (Chan et al. 2005). Treatment within RHCAs would generally follow a thin from below prescription that would focus on removal of smaller diameter trees and ladder fuels. To achieve a forest health component, some larger diameter trees (<24 inches d.b.h.) may be harvested to open the canopy, allow increased sunlight to the forest floor, and improve growing potential for residual shade intolerant conifer and riparian species. Within all treated stands, canopy cover would not be reduced below 35 percent and would range from 39 percent to 68 percent.

Integrated design features to be implemented to minimize impacts to channel shade include:

- No trees over 8 inches d.b.h. would be removed within ten feet of a channel.
- No trees greater than 24 inches d.b.h. would be removed.
- No riparian hardwood species (alder, willow, aspen, cottonwood) would be removed.

It is estimated that following thinning activities within perennial stream RHCAs, stream channel shade would be reduced on the treatment stand scale by approximately 10 percent. Across the entire project area, it is proposed to thin approximately 8 percent of the perennial stream inner zone RHCAs.

Proposed aspen enhancement would occur within approximately 74 acres (4 percent) of perennial stream inner zone RHCAs in the project area. Aspen enhancement prescriptions require a much greater reduction in canopy where aspen are dominantly shaded by conifer. It is expected that canopy cover (outside of stream cover) would be reduced to approximately 5 percent to 20 percent following thinning of conifers in the stand. Where conifers would be removed in close proximity to stream channels, a large reduction in channel shade may occur. At the site scale, this may cause short-term (0 to 5 years) increases in solar input to channels. In the long-term it is expected that lost channel shade as a result of thinning would be replaced by regenerated aspen and other riparian hardwood species. Recent monitoring at two aspen enhancement sites on the Lassen National Forest where conifers were removed along perennial stream channels (Pine Creek and SF Bailey Creek) found stream shade dropped approximately 10 percent the year following conifer removal (HFQLG Stream Monitoring Annual Summaries from 2005 and 2007). Water temperature data collected at these sites indicated there was no increase in water temperature.

Of the total 72 acres of proposed treatment within and/or adjacent to wet meadow habitat, approximately 45 acres are associated with thinning activities within RHCAs, while the remaining 27 acres are associated with aspen enhancement units (Table 83). For those within RHCA thinning units, the most likely change in forest canopy, and air and standing water temperatures would be localized near the outer edges of the wet meadow habitat. While a decrease in canopy cover would occur within the inner zone RHCAs surrounding wet meadows, expected changes in ambient air temperatures and water temperatures (where standing water exists) would not be negligible. As described above, where aspen enhancement treatments would occur within wet meadow habitats, canopy cover would be reduced to a greater degree than that expected within RHCA treatments. Therefore, the risk of increased ambient air and water temperature is greater. However, because warmer water temperature is conducive to embryo and tadpole development, reduction in canopy cover within potential suitable habitat may improve breeding habitat for Cascades and Sierra Nevada yellow-legged frogs. Furthermore, as stated above, observations of Cascades frog larvae, recently metamorphosed frogs, sub-adults, and adults on the Lassen National Forest have generally been observed in habitats with open forest canopies (<25 percent).

In summary, the risk of negative indirect effects to ambient air temperature and water temperature adjacent to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs is considered low. Thinning and aspen enhancement actions proposed within inner zone RHCAs would result in short-term decreases in channel shade at the stand scale. Due to the limited area proposed for RHCA thinning (148 acres) and aspen enhancement (74 acres) adjacent to perennial stream habitat, decreased channel shade would not result in significant increased water temperatures within potential suitable habitat found in perennial stream channels. Where treatments would occur within and adjacent to wet meadow habitats (101 acres), the expected decrease in forest canopy cover and low risk of increased water temperature may result in a low potential for beneficial indirect effect to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs.

Sediment

The watershed and aquatics analysis for the project concluded that forest harvest and thinning activities would not be expected to measurably increase delivery of sediment to stream channels. Under both alternative 2 and alternative 3, vegetation management activities (thinning and aspen enhancement) within or adjacent to approximately 294 acres of potential suitable habitat would occur (Table 93). If measurable increases in sediment did occur, this impact would be isolated to potential suitable habitat within perennial stream channels. Off-channel habitat commonly used for breeding would not be affected as these areas are typically not hydrologically connected to stream channels except during high runoff events. However, at these times, breeding and development of egg masses and tadpoles would have been completed; thus individuals would not be present in off channel habitat. The risk of increased sediment production to perennial stream habitat resulting from these activities would be minimized through implementation of RHCA specific integrated design features, and soil quality standards that include the following:

- No mechanical equipment will be allowed within feet of stream channels
- No mechanical treatment will occur within RHCAs where slopes are greater than 20 percent
- Skid trails are to be left with 90 percent ground cover after operations
- Forest floor cover in the inner zone of RHCAs will be maintained at a minimum of 90 percent of pre-treatment levels
- Conifers would be harvested with low-ground pressure rated feller-bunchers that have 24-inch or greater track widths
- No group selection cuts would occur in the RHCAs, although aspen treatments require the removal of most of the conifers below 30 inches d.b.h.
- Turning of tracked feller-bunchers would be kept to a minimum
- Soils must be dry to a depth of 12 inches during mechanical operations

Under alternative 2 and alternative 3, there would be no new road construction or road reconstruction within potential suitable habitat for Cascades or Sierra Nevada yellow-legged frogs. Furthermore, there would be no construction of new landing within RHCAs. However, outside of these habitats both alternatives would construct 3.6 miles of new temporary roads, and reconstruct 2.9 miles of already existing non-National Forest System roads as temporary roads. These temporary roads will be constructed to follow the rise and fall of the land to reduce excavation. All temporary roads would be reclaimed and rehabilitated to a near natural condition after project activities are completed. Additionally, as mentioned above, approximately 11.1 miles of existing road would be decommissioned across the project area. These actions should result in reduced impermeable surface in affected subwatersheds, and lead to long-term reduction in sediment transported to potential suitable habitat.

No new road crossings would be constructed. Eighteen seasonal stream crossings on existing non-system roads would be removed when these roads are decommissioned. Two of these are in the Grizzly Creek watershed; the others are in the Fanani (lower Butt Creek) and Shanghai sub-watersheds. Removal of these crossings should result in a short-term sediment increase to potential suitable habitat located within perennial stream reached located downstream of these crossings. However, in the long-term, sediment production rates would be reduced below current levels.

The project would apply or improve surfacing at approximately 72 road channel crossings in the project area. Because these crossings are the primary source of increased sediment delivery to project area channels, reduction in sediment delivery from the project area is expected in both the short and long-terms. Reductions in sediment delivery will also result from treatment of up to 7.3 miles of road surface (apart from crossings). This will result in reduction of sediment delivery in both the short and long term.

In summary, alternative 2 and alternative 3 pose a low risk of increased sediment production to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs. Vegetation management activities within and adjacent to perennial stream channels and wet meadows would be minimized through implementation of integrated design feature and soil quality standards specific to RHCAs. Additionally, the transportation actions which include decommissioning, surfacing, and removal of undersized stream crossing would further reduce current sediment production trends in the project affected subwatersheds over the long-term.

Summary of indirect effects

Alternative 2 and alternative 3 pose a low risk of negative indirect effects to potential suitable habitat for Cascade frog and Sierra Nevada yellow-legged frog habitat, including change to the amount of suitable habitat, or quality of habitat.

Cumulative Effects

Factors contributing to the decline in amphibian populations worldwide include: acid precipitation, chytridiomycosis, ultraviolet radiation, global climate change, non-native fish predation, drought, loss of aquatic habitat, decline in habit quality, and increases in erosion and runoff because of changes in land use and land cover. Within the project area, non-native fish (brook trout and/or brown trout) are present in Butt, Water, Rock, Sawmill Tom and Yellow Creeks and may have impacted distribution of amphibians but project activities will not affect distribution of these trout species. Of the factors listed above, changes in ambient air and water temperatures, and increased sediment delivery are the cumulative effect of most concern related to the project. This is because the project involves activities that alter existing forest canopy cover within and adjacent to potential suitable habitat, and ground disturbing activities. Factors that may be contributing to cumulative effects to Cascades frogs and Sierra Nevada yellow-legged frogs originating from privately owned lands include past, current and future timber harvest, roads, and grazing practices.

Temperature/ Channel Shade

As mentioned above within the indirect section, alternative 2 and alternative 3 would likely result in changes in existing forest canopy adjacent to and within potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs. As a result, a low risk of negative indirect effects to ambient air and water temperature may occur within potential suitable habitat.

To assess the cumulative effects of those actions contained within alternative 2 and alternative 3, stream channel shade was analyzed at the subwatershed scale (Table 94). In general, perennial stream channel shade in the project area falls within the natural range of variability for headwater streams flowing through mixed conifer stands with varying widths of riparian vegetation (id. alder, willow, aspen, etc). On average, perennial stream channel shade on National Forest System lands is approximately 67 percent. The lowest average stream channel shade conditions were found within Butt Creek and Yellow Creek. In general, these two systems have had the greatest degree of disturbance within areas adjacent to stream channels as a result of poor road location, historic grazing practices, and large runoff events that have disturbed or removed vegetation on stream banks.

Table 94. Summary of proposed vegetation treatments within RHCAs in alternatives 2 and 3

Prescription	RHCA Classification	Inner Zone Acres	Outer Zone Acres	Total Proposed Acres
A-E, O	Perennial	148	144	292
	Seasonal	40	47	87
Aspen (F)	Perennial	74	58	132
Aspen (F)	Seasonal	12	10	22

In summary, our analysis concludes that alternative 2 and alternative 3 pose a low risk of cumulative effects to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs.

Alternative 4

Direct Effects

The likelihood of direct effects to Cascades and Sierra Nevada yellow-legged frogs with implementation of alternative 4 is low, as these species are not known to presently occur in the project area. However, if Cascades frog or Sierra Nevada yellow-legged frog are located within the project area and have gone undetected, the highest risk of direct effects would occur as a result of proposed treatments located within inner zone RHCAs adjacent to perennial streams and wet meadows. In these areas, mechanical equipment would be utilized to implement the non-commercial fuels objective within inner zones adjacent to perennial streams (146 acres) and wet meadows (approximately 3 acres) (Table 95). If frogs where present at the time of implementation of fuels reduction activities, there would be a risk of individual mortality through contact with mechanical equipment or felled logs. The risk of direct effects would be minimized through RHCA specific integrated design features including equipment exclusion zones extending 25 feet from all stream channels, 150 feet from all designated fens, and soil moisture restrictions that would limit both spatial and temporal disturbance in those areas that likely provide potential suitable habitat.

Table 95. Summary of proposed vegetation management activities for alternative 4 within or adjacent to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs in the Creeks II project area subwatersheds

Subwatershed	Vegetation Treatments within Perennial Stream Inner Zone RHCAs	Vegetation Treatment within Wet Meadow Habitat (includes RHCA inner zone)
	Proposed Thinning	
Fanani	8	0
Grizzly Creek	37	3
Humbug Valley	0	0
Lemm Hollows	42	0
Ruffa	23	0
Shanghai Creek	7	0
Soda Creek	22	0
Upper Yellow	7	0
Soldier Creek	0	0
Total Acres	**146**	**3**

Prescribed burning would also occur within RHCAs and could affect individuals crossing through upland habitats if Cascades frog or Sierra Nevada yellow-legged frog populations have gone undetected and burning was conducting during periods when the species are moving from or to aquatic habitats. However, because these units would be burned during the fall months when Cascades frogs and Sierra Nevada yellow-legged frog would likely not be located within upland habitat, the risk of direct effects is negligible.

Potential chemical contamination to Cascades and Sierra Nevada yellow-legged frog from borate application is not expected to occur because the species in not believed to occur in the project area and application in the inner zones of RHCAs surrounding potential suitable habitat is negligible. Borate would not be applied to within 25 feet of any standing water, or within any aspen enhancement units. If individual frogs came in contact with borax on or near treated stumps, sickness or mortality could occur. The likelihood of this is rated as negligible due to minimal treatments in the inner zones of RHCAs surrounding potential suitable habitat.

Indirect Effects

Potential indirect effects to Cascades and Sierra Nevada yellow-legged frogs under alternative 4 would be the same as those analyzed for alternatives 2 and 3 above. These include:

Changes in air and water temperature - Canopy removal as a result of silvicultural treatments in RHCAs, could change the temperature regime (water and ambient air) in potential suitable habitats. Changes in water and air temperatures could affect survival rates, growth rates and reproductive success.

Changes in sediment regime- As a result of changes in hillslope runoff, accelerated erosion, and peak flows, increased sediment could impair water quality and affect survival and growth rates of Cascades, and Sierra Nevada yellow-legged frogs.

Air Temperature/ Water Temperature

Potential effects to air and water temperature adjacent to and within potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs would be similar to those described above for alternatives 2 and 3. Specifically, where fuels reductions would occur adjacent to perennial streams and wet meadows. Treatments would occur within approximately 146 acres of perennial stream inner zone RHCAs and three acres of wet meadow habitat (Table 95). As described in the proposed action, aspen enhancement activities proposed under alternatives 2 and 3 would not be implemented under alternative 4. Thus, the spatial risk of indirect effects to Cascades and Sierra Nevada yellow-legged frogs would be less than that associated with alternatives 2 and 3.

As described in the proposed action, the objective of alternative 4 is to implement a non-commercial fuels treatment where following vegetation management activities, flame lengths would be less than four feet and canopy base heights would be greater than 20 feet. To achieve this objective, it has been determined that all conifers less than 12 inches d.b.h. located within inner zone RHCAs would be removed. It is anticipated that following implementation, canopy cover would be reduced to approximately 37 percent (average). As a result, there is a low risk of short-term increased ambient air and water temperatures within potential suitable habitat for Cascades frogs and Sierra Nevada yellow-legged frogs. In the long-term, it is expected that growth and expansion of the remaining canopy would fill in these gaps and trend conditions to pre project conditions. As such, there is a low risk of increased ambient air and water temperatures within potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs.

Integrated design features to be implemented to minimize impacts to air and water temperatures within potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs:

- No trees over 12 inches d.b.h. would be removed within ten feet of a channel.
- No trees greater than 12 inches d.b.h. would be removed.
- No riparian hardwood species (alder, willow, aspen, cottonwood) would be removed.
- Average canopy cover would not be reduced below 30 percent.

In summary, the risk of indirect effects to water temperature and air temperature is considered low.

Sediment

Similar to alternatives 2 and 3, the risk of increased sediment to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frog habitat is considered low if implementation of alternative 4 were implemented. Likewise, potential increases in sediment would be limited to perennial stream habitat adjacent to, and directly downstream of the 146 acres proposed for surface fuels and ladder fuel reduction within perennial inner zone RHCAs. The risk of increased sediment production to perennial stream habitat resulting from these activities would be minimized through implementation of RHCA specific integrated design features and soil quality standards that include the following:

- No mechanical equipment will be all owed within 25 feet of stream channels
- No mechanical treatment will occur within RHCAs where slopes are greater than 20 percent.
- Skid trails are to left with 90 percent ground cover after operations.
- Forest floor cover in the inner zone of RHCAs will be maintained at a minimum of 90 percent of pre-treatment levels
- Conifers would be harvested with low-ground pressure rated feller-bunchers that have 24-inch or greater track widths
- Turning of tracked feller-bunchers would be kept to a minimum
- Soils must be dry to a depth of 12 inches during mechanical operations

Although there are less acres being treated in alternative 4 than alternatives 2 and 3, there would be a higher overall risk for sediment erosion and delivery. There are two primary reasons for this increased risk: first, the decommissioning of the unneeded roads and OHV trails and their associated stream crossings would not occur. These features would continue to erode and pose long term risks to water quality. Second, the surfacing of crossings included in alternatives 2 and 3 has been removed from this alternative. Pre-haul maintenance and an increase in traffic would cause more erosion from the roads used in the project. However, there would be fewer new temp roads that would be needed for the project.

Since this project would still use all the integrated design features and BMPs and not drastically expand the road network, there may be a small increase in the short-term erosion of sediment, but it is not foreseen to be significantly detrimental to streams in the project area.

Summary of indirect effects

Alternative 4 poses a low risk of indirect effects to potential suitable habitat for Cascades frogs and Sierra Nevada yellow-legged frog habitat, including changes in air temperature, water temperature, or changes in sediment.

Cumulative Effects

Similar to alternatives 2 and 3, changes in ambient air and water temperature, and increased sediment delivery are the cumulative effects of most concern related to alternative 4. This is because this alternative contains actions that would alter existing forest canopy cover within and adjacent to potential suitable habitat, and ground disturbing activities that may increase the risk of sediment production to perennial stream channels.

Air Temperature/ Water Temperature

As mentioned above within the indirect section, alternative 4 would likely result in changes in existing forest canopy adjacent to and within potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs. As a result, a low risk of negative indirect effects to ambient air and water temperature may occur within potential suitable habitat.

At the cumulative effects scale, which encompasses the nine project affected subwatersheds that contain potential suitable habitat (Table 92), the risk of cumulative effects to air and water temperatures is determined to be low for the following reasons.

- Of the 3,193 acres (National Forest System and private lands) of perennial stream channel inner zone RHCAs in the project affected subwatersheds, only 146 acres (4 percent) would include fuels reduction activities associate with alternative 4.
- Of the 2,780 acres (National Forest System and private lands) of wet meadow habitat in the project affected subwatersheds, only 3 acres (0.1 percent) would be treated to reduce surface and ladder fuels.
- Due to the limited area proposed for treatment, the expected low risk of negative indirect effects to potential suitable habitat for Cascades and Sierra Nevada yellow-legged frogs through changes in air and water temperatures would not be realized at the subwatershed or cumulative effects scale.
- Through implementation of RHCA specific integrated design features, including an upper diameter limit of 12 inches d.b.h., and that no trees greater than 8 inches d.b.h. within 10 feet of any stream channel would be removed.
- There are no actions that would increases grazing pressure within the project affected subwatersheds, which has historically impacted canopy cover within potential suitable habitat including perennial stream channels and wet meadows.

Sediment

As described above in the indirect effects section, alternative 4 poses a low risk of increased sediment to potential suitable habitat in the project area. Specifically, perennial stream channel habitat located adjacent to, or downslope of proposed ground disturbing activities including fuels reduction and transportation activities.

At the cumulative effects scale, which encompasses the nine project affected subwatersheds that contain potential suitable habitat (see Table 92), the risk of cumulative effects of increased sediment production to potential suitable habitat in the project area is considered to be low for the following reasons:

- Of the 3,193 acres (National Forest System and private lands) of perennial stream channel inner zone RHCAs in the project affected subwatersheds, only 146 acres (4 percent) would include fuels reduction activities associate with alternative 4.
- Of the 2,780 acres (National Forest System and private lands) of wet meadow habitat in the project affected subwatersheds, only 3 acres (0.1 percent) would be treated to reduce surface and ladder fuels.
- No mechanical equipment will be all owed within 25feet of stream channels
- No mechanical treatment will occur within RHCAs where slopes are greater than 20 percent.
- Skid trails are to left with 90 percent ground cover after operations.
- Forest floor cover in the inner zone of RHCAs will be maintained at a minimum of 90 percent of pre-treatment levels
- Conifers would be harvested with low-ground pressure rated feller-bunchers that have 24-inch or greater track widths
- Turning of tracked feller-bunchers would be kept to a minimum
- Soils must be dry to a depth of 12 inches during mechanical operation
- There are no actions that would increases grazing pressure within the project affected subwatersheds, which has historically impacted canopy cover within potential suitable habitat including perennial stream channels and wet meadows.

Aquatic Management Indicator Species

Species Considered

The Record of Decision (ROD) for the Sierra Nevada Forests Management Indicator Species Amendment (USDA 2007a) outlines the procedures for analyzing the effects to MIS. Prior to the MIS amendment to the Forest Plan, a project analysis considered impacts to individuals whereas the current direction provided by the ROD relies on analyzing the impacts to habitat and comparing the changes to habitat trends throughout the Sierra Nevada. The projected impacts to species is based on bioregional trends as outlined in the Sierra Nevada Forests Management Indicator Species Amendment.

The MIS report prepared for this project determined that eight MIS habitats (terrestrial and aquatic) could be affected. The following effects analysis summary will address the two aquatic MIS habitats that could be affected in the project. The remainder of the MIS are addressed in the terrestrial wildlife section.

The Forest Plan (USDA 1993) originally identified 18 MIS for the Lassen National Forest but was amended with new direction for MIS in 2007. Habitats were defined for specific species and the analysis focuses on changes in habitat rather than the impact to individuals. The effects to species are considered at the bio-regional (Sierra Nevada) scale based on the change in habitat trends.

Methodology

The following section documents the analysis for macroinvertebrates and the Pacific tree frog. The analysis of the effects of the Creeks II project on the MIS habitat for the selected project-level MIS is conducted at the project scale. The analysis used the following habitat data: Vegetation mapping developed by Vestra and modified by site-specific data (stand exams). The GIS layer of perennial stream features defined by the National Hydrography Dataset. Detailed information on the MIS is documented in the Sierra Nevada Forests Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

Effects of the project were considered at multiple scales. On site impacts of activities to soils and streamside areas were considered. Indirect impacts to stream habitat were considered at the scale of the sub-watersheds within the project area. Cumulative effects were considered at both the sub-watershed scale, and the larger scale of the Yellow Creek, Butt Creek, and North Fork Feather River watersheds. Finally, project level effects are related to habitat trends at the bioregional scale.

Cumulative effects at the bioregional scale are tracked via the SNF MIS Bioregional monitoring, and detailed in the SNF Bioregional MIS Report (USDA Forest Service 2008). Cumulative effects were based on the activities that are expected to occur on both private and federal lands within the project area.

Direct and Indirect Effects

Table 96 outlines the various aquatic MIS, whether their habitat would be affected, and the amount of habitat found within the project area.

Table 96. Selection of MIS for project-level habitat analysis for the Creeks II project

Scientific Name	Habitat or Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component	Category for Project Analysis[a]
aquatic macroinvertebrates	Riverine & Lacustrine	lacustrine (LAC) and riverine (RIV)	3
Pacific tree frog *Pseudacris regilla*	Wet Meadow	Wet meadow (WTM), freshwater emergent wetland (FEW)	3

a - Category 1: MIS whose habitat is not in or adjacent to the project area and would not be affected by the project.
Category 2: MIS whose habitat is in or adjacent to project area, but would not be either directly or indirectly affected by the project.
Category 3: MIS whose habitat would be either directly or indirectly affected by the project.

Table 97 provides an estimate of the changes to MIS aquatic MIS habitat after the implementation of each alternative. In addition to the amount (acres) of MIS habitat within the project area, analysis was further done to assess potential indirect effects of the proposed actions would have on the quality of habitat.

Table 97. Change of aquatic MIS habitat within the project area by alternative on National Forest System lands

MIS Habitat –	Acres of Habitat within Project Area (Alt 1)	Post Treatment MIS Habitat Acres (Alt 2)	Change in MIS Habitat Acres	Post Treatment MIS Habitat Acres (Alt 3)	Change in MIS Habitat Acres	Post Treatment MIS Habitat Acres (Alt 4)	Change in MIS Habitat Acres
Riverine & Lacustrine	48 (87)	48 (87)	0	48 (87)	0	48 (87)	0
Wet Meadow	290 (2,280)	290 (2,280)	0	290 (2,280)	0	290 (2,280)	0

Analysis of pre and post CWHR data reveals that aquatic MIS habitat in the project area is not expected to change through implementation of any alternative associated with the proposed project. However, where alternatives 2, 3 and 4 propose vegetation management activities within or directly adjacent to wet meadow habitat, a slight increase in habitat may occur as a result of increased sunlight to the forest floor, increased water availability, and increased distribution of short and tall herbaceous vegetation.

No direct effects to riverine and lacustrine habitats are expected under all alternatives as there would be no activities that directly disturb perennial stream channels. In general, the quality of riverine and lacustrine habitats should improve in the long-term following implementation of alternatives 2, 3, and 4. However, because alternative 4 would not include transportation activities designed to reduce sedimentation, these effects would be less than those expected under alternatives 2 and 3.

As mentioned above, there is a slight potential for wet meadow habitat in the project area to increase at the site scale, following vegetation treatments near wet meadow habitat under alternatives 2, 3, and 4. Direct disturbance of wet meadow habitat would occur within approximately 16 acres of aspen enhancement (alternatives 2 and 3), although these actions should not result in changes to the amount of habitat, change in height and ground cover class, or hydrology post project.

Determination of Effects to Aquatic MIS

Because the risk of potential direct, indirect and cumulative effects to aquatic MIS species habitat is considered low, the project will not lead to any changes in habitat trend for this aquatic MIS at the bio-regional scale. In general alternative 2, 3, and 4 should result in improved quality of aquatic MIS habitat within the project area subwatersheds, and a slight potential for expansion of wet meadow habitat at the site scale.

Cumulative Effects

The cumulative effects area of consideration for aquatic MIS is the project area subwatersheds. The risk of cumulative affects to aquatic macro-invertebrate habitat relative to changes in channel sediment and stream channel shade resulting from past, present, and future management activities in the project subwatersheds is considered low. The greatest potential for cumulative effects would be from increased delivery of sediment and changes to stream channel shade, in addition to potential impacts from on-going or future land disturbance activities that could cause adverse cumulative change to habitat in the project area.

Soils

This section provides an analysis of the effects of the Creeks II project on the long-term productivity of soils in the project area. Included in this section are: a description of the soils in the project area, an assessment of current soil conditions, analysis of the potential effects that treatments under the various action alternatives might have on the soil resource, and references to integrated design features (IDFs) that would minimize adverse effects on long-term soil productivity. This section is a summary of the soils resources report which includes further details (see planning record).

Management Direction and Laws

The management direction in the Lassen Forest Plan (USDA Forest Service 1993) and the Herger Feinstein Quincy Library Group (HFQLG) Forest Recovery Act of 1999 provide the following standards for assessing soil condition and for evaluating the effects of the Creeks II project on soil productivity:

- The areal extent of detrimental soil disturbance will not exceed 15 percent of the area dedicated to growing vegetation.
- Soil cover is sufficient to prevent the rate of accelerated soil erosion from exceeding the rate of soil formation.
- Soil porosity and bulk density are at least 90 percent of the measurements found under undisturbed or natural conditions.
- Organic matter is present in amounts sufficient to prevent significant short or long-term nutrient cycle deficits.
- Soil organic matter in the upper 12 inches of soil is at least 85 percent of the total soil organic matter found under undisturbed or natural conditions.
- Forest floor occurs on at least 50 percent of the area.
- Large woody material, when occurring in the forested area, is at least 3 logs per acre in contact with the soil surface; and represents the total range of decomposition.

The 2004 Sierra Nevada Framework (USDA Forest Service 2004) provides a mandate to address the effects of management treatments on soil hydrologic functioning and soil buffering capacity. This includes predictions of the proposed management activities on soil water holding capacity, nutrient cycling, microbial and invertebrate population functionality and health.

Including predictions of management activities on carbon sequestration in National Environmental Policy Act (NEPA) documentation is recommended by the Forest Service's Strategic Framework for Responding to Climate Change (2008). Currently, there is not an accepted standard for evaluating the impacts of management on carbon sequestration potential and, as such, inclusion of carbon sequestration analysis should not impact the consistency of project alternatives with forest standards. However, in order to provide interested stakeholders with information regarding potential management effects on carbon sequestration, Region 5 soil scientists are including this information in soil resource reports using the most current information available.

Methodology

Field Observations

Field visits were conducted in order to achieve the following goals: 1) to validate existing Lassen National Forest soil survey mapping; 2) to gather information on site-specific soil properties, and; 3) to assess current soil conditions as affected by past management activities. Field surveys were conducted in July 2008 and June 2010.

Measurement Indicators

There are no purpose and need objectives that are measureable under the soils analysis.

Each alternative will be assessed by six impact indicators of the soil resource that are mandated by federal, regional and/or Lassen National Forest soil standards (see management standards, guidelines and direction section above).These include:

1. Ground cover and soil organic matter

2. Erosion potential - Erosion hazard ratings were calculated for maximum erosion hazard risk by assuming moderate ground cover removal during proposed treatment by mechanical equipment. Maximum erosion hazard rating is used to assess the potential risk of accelerated sheet and rill erosion. The erosion hazard rating is calculated using the soil series (from the family association) that is most prone to soil erosion. Categorical values for rating the potential erosion hazard of soils are based on soil texture, climate, water movement, soil cover in tandem with slope steepness and length and range in value from low, moderate, high, to very high

3. Compaction Potential - Maximum detrimental compaction risk describes the potential of a soil to lose porosity, and hence, productivity, caused by heavy machinery operation. The detrimental compaction risk rating is calculated using the soil family (from the family association) that is most prone to compaction. Typically, soils most prone to compaction are those that have either high clay concentrations or lack coarse fragments in the soil.

4. Impacts to hydrologic functionality

5. Impacts to soil buffering capacity

6. Carbon sequestration potential

Spatial and Temporal Context for Effects Analysis

The project area was used as the boundary to assess effects because potential soils effects would be expected to be confined to this area. The interpretation of cumulative effects includes the effects on the soil resource of past, present and future actions within the project boundary. A detailed description of the past, ongoing and reasonably foreseeable future actions are included in appendix E. Temporally, direct effects were assessed as immediate effects due to Creeks II proposed project treatments; indirect and cumulative effects were assessed for longer-term effects ranging from decades to millennia as indicated in the ensuing effects discussions.

Affected Environment

Based on soil samples from sixteen transects, the project area is considered to be consistent with soil standards for cover, soil organic matter, forest floor, soil porosity and total areal extent of detrimental disturbance.

Soils

Soils in the Creeks II project area are derived primarily from volcanic parent material, chiefly in the form of colluvium and residuum from basalt and andesite (USDA NRCS 2009b). Soil characteristics relevant to proposed treatment areas are outlined below in Table 98. A description of climate and topography of the project area is included in Chapter 1 under the Location and Description of the Project Area section.

Soil textures in the project area encompass a broad spectrum of textures and are included here in order to aid in the assessment of potential erosion and compaction hazards. Textures of both the surface and near-surface soils were included in Table 98 as these soils are the most sensitive to erosion and compaction.

Ratings for erosion hazard in the project area range from low to very high (Table 98; Figure 27). The high and very high ratings tend to be located in areas with steep slopes and often do not overlap with proposed treatment area boundaries.

Ratings for compaction risk in the project area range from low to high, with an extensive area covered by high risk soils (Table 98; Figure 28).

Table 98. Description of soil map units within Creeks II project boundary

Map Unit	EHR[a]	DCR[b]
3	L	H
23	M	H
24	M	H
25	H	H
36	M	M
37	H	M
59	H	L
60	VH	L
74	na	na
79	M	M-H
84	M	L
85	VH	L
86	M	L
92	VH	L
93	M	L
97	M	H
98	H	H
123	M	H
128	M	H
129	VH	H
130	M	L
131	VH	L

Source: USDA NRCS 2009b
a - Erosion Hazard Rating (EHR: L = low, M = medium, H = High, VH = very high)
b - Detrimental Compaction Risk (DCR: L = low, M = medium, H = High).

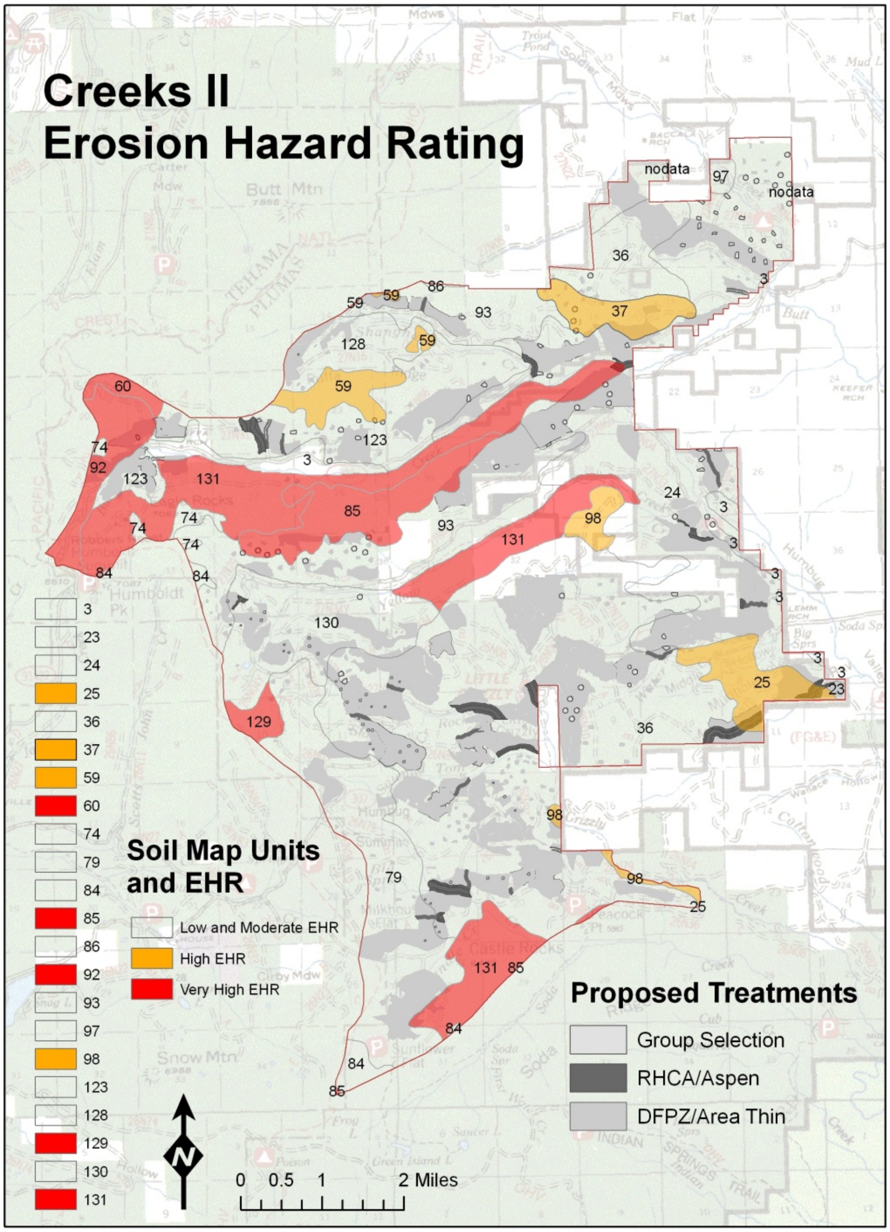


Figure 27. Project area map showing soil map unit boundaries (identified by numeric values in map), potential treatment areas and erosion hazard ratings

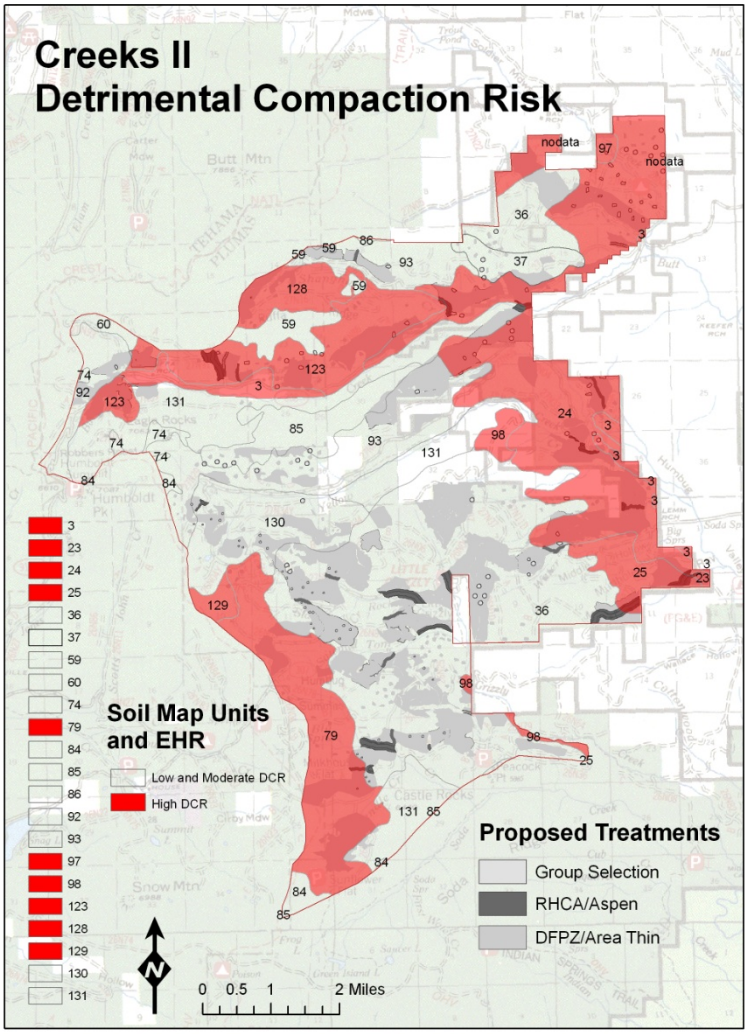


Figure 28. Project area map showing soil map unit boundaries (identified by numeric values in map), potential treatment areas and detrimental compaction risk ratings

Existing Condition

The following assessment of current soil condition in terms of the Lassen National Forest soil standards is based on the results of extensive field sampling. Past and ongoing management activities in the project area contribute to the current condition and are described in detail for the past 30 years in appendix E. The results of the field sampling are summarized below and described in greater detail in the soil resources report (planning record).

Ground Cover and Soil Organic Matter

Total Ground Cover

All areas sampled averaged greater than 93 percent ground cover (including vegetation, forest floor and large woody materials), thereby serving to minimize the erosion potential of the soil resource. RHCAs sampled also averaged greater than 93 percent ground cover. Taken together, ground cover within the Creeks II project area is consistent with forest standards and does not indicate a loss in soil productivity.

Soil Organic Matter

Surface erosion was minimal and restricted to landings and skid trails near landings. There was minimal evidence of surface erosion in map units 60, 85, 92 or 131 (only where roads intersected steep slopes) where slopes and erosion hazard rating values were high (Table 98; Figure 27). Soil organic matter loss probably exceeded standards only on small portions of the landings and main skid trails, but the overall project area was assessed as compliant with forest standards.

Forest Floor (Fine Surface Organic Matter)

All forested sites exceeded the Lassen Forest Plan standard for forest floor. The majority of sites averaged 1-3 inches of forest floor over 93 percent of the sampled area. In several areas that showed evidence of burning, forest floor was reduced below 93 percent, but was always higher than the 50 percent Lassen National Forest standard. However, the high amount of forest floor coupled with high canopy light interception in forested areas likely precluded the development of an herbaceous understory which was mostly absent in forested areas. In meadow areas, forest floor was often below 50 percent coverage due to the lack of overstory input of needles and likely high rates of decomposition of understory input. This is consistent with the Sierra Nevada Forest Plan Amendment which describes the standard for forest floor cover as the cover that is representative of the 'natural' condition. In meadow ecosystems, it is expected that forest floor would be reduced and that herbaceous inputs would be high. Instead, it is more appropriate to quantify the herbaceous cover in meadows to assess the stability of nutrient capital present in the soil. In the meadow areas, herbaceous cover was over 93 present in all areas measured except for skid trails and landings.

Large Woody Debris

The standard of 3 logs per acre in forested areas for large woody debris was met (see also silviculture section). Integrated design features would be included in any future management activities that would strive to ensure consistency with the forest standard of 3 logs per acre (appendix A).

Erosion

The presence of active erosion or sediment movement was observed in landings, on road cuts, fills and in ditches. The presence of ground cover typically precludes the loss of soil organic matter from erosion. On average, there was minor evidence of erosion and these erosional losses were not of sufficient quantity to indicate a resource concern (i.e. the current condition is consistent with forest standards).

Soil Compaction

The areal extent of compaction in the project area is under the 15 percent standard for detrimental soil disturbance, thereby consistent with forest standards.

Environmental Consequences

The proposed project actions comply with forest soil standards and guidelines, increase soil hydrologic functioning (in terms of water availability to understory species), soil buffering capacity, and carbon sequestration potential, as outlined in the Lassen Forest Plan (1992), Region Five Soil Quality Standards (1995), the Sierra Nevada Forest Plan Amendment (2004) and the Forest Service's Strategic Framework for Responding to Climate Change (2008). The following is a summary of effects to soils. Further analysis is included in the soils resources report in the planning record.

Direct and Indirect Effects

Alternative 1

Alternative 1 is a no-action alternative and as such there are no direct or cumulative effects to the soil resource. The indirect effects of alternative 1 would include continued accumulation of forest floor and large woody debris thereby increasing the risk of wildfire. Standing replacing wildfires can result in reduced long-term soil productivity, loss of ground cover, increased erosion hazard, long-term losses of soil organic matter and long-term losses of carbon pools and carbon sequestration potential. See soil resources report for further details.

Impact Indicator 1 - Ground Cover and Soil Organic Matter

The adoption of the no-action alternative would result in the continued accumulation of forest floor thereby increasing the risk of a stand-replacing wildfire (see fuels section) as well as continued reductions in understory vegetative production and diversity. In the case of stand-replacing wildfire, ground cover and soil organic matter would be lost to volatilization, while soil organic matter would continue to be lost for decades to centuries due to reduced productivity from soil heating (Dore et al. 2008).

Impact Indicator 2 - Erosion Potential

Erosion potential will be maximized due to the increased risk of a stand replacing wildfire. Several areas within the Creeks II project area have slopes over 70 percent and are at extreme risk to erosion in the event of a wildfire. Stand replacing wildfires result in the mortality of soil binding fungi, roots, and ground cover that act together to retain soil organic matter. The loss of ground cover and the formation of water repellent soils following wildfire would increase the risk of accelerated erosion and a consequent long-term (i.e. several millennia) and irrecoverable loss of topsoil and soil organic matter.

Impact Indicator 3 - Compaction Potential

Compacted soils in the project area would potentially benefit from alternative 1. In the long-term, continued mixing of soils from roots would increase soil porosity and alleviate compaction.

Impact Indicator 4 - Impacts to Hydrologic Functionality

Hydrologic functionality would be reduced in the event of a stand replacing wildfire. As described above, increased water repellent surface layers, reduced soil aggregate stability, and soil reduced soil organic matter content would reduce soil water holding capacity.

Impact Indicator 5 - Impacts to Soil Buffering Capacity

Soil buffering capacity would be impaired in the event of a stand replacing wildfire. Reduced soil aggregate stability and soil surface area would reduce cation exchange capacity and hence the ability of the soil to retain nutrients and water. Furthermore, the loss of nitrogen through volatilization would reduce the soil nutrient availability and productivity. Reductions in inputs to the microbial community would reduce microbial biomass. Recovery of productivity, nutrient capital and microbial communities would depend on the rate of recovery of the vegetation but would be expected to take anywhere from decades to centuries.

Impact Indicator 6 - Carbon Sequestration Potential

Carbon sequestration potential would be severely reduced in the event of a stand replacing wildfire. This loss would not be restricted to the biomass volatilized during the fire, but would also include the long-term loss of soil carbon due to loss of productivity coupled with increased heterotrophic respiration caused by increased soil temperatures. These consequences would continue to degrade the soil resource until vegetation recovers enough to moderate soil temperatures. This recovery would likely take several decades to centuries to occur, especially in areas with low initial productivity potential.

Alternatives 2, 3, and 4

The forest management activities proposed in the three action alternatives (2, 3, and 4) involve ground-disturbing activities with mechanized equipment. These activities have the potential to negatively impact productivity through short-term increases in soil compaction, soil erosion, and short-term decreases in soil cover. The application of integrated design features, particularly, restricting mechanized operations to periods when soils have high strength to resist compactive forces, would mitigate the potential for soil compaction. Limiting operations to slopes less than 35 percent overall and less than 20 percent in RHCAs would reduce the potential impact for soil erosion. Loss of soil cover would be moderated by increased understory productivity and continued overstory litterfall at a marginally reduced rate. All three action alternatives would be compliant with forest soil standards.

The indirect effects of the management treatments proposed under the action alternatives would benefit the soil hydrologic functioning, soil buffering capacity and carbon sequestration potential with alternative 2 having the highest degree of benefits, alternative 4 with the lowest degree of benefits and alternative 3 with an intermediate degree of benefits.

The primary difference between the action alternatives is that compared to alternative 2, alternative 4 reduces the acres treated by several thousand acres and reduces the degree of overstory removal and alternative 3 reduces the degree of overstory removal. As compared to the heavier thins of alternative 2, alternatives 3 and 4 (even less than 3) would only marginally enhance soil hydrologic functioning and soil buffering capacity. The limited response would be due to decreased change in canopy light interception and transpiration rates compared to the heavier thins, and hence, little or no change in understory productivity.

Impact Indicator 1 - Ground Cover and Soil Organic Matter

In the short-term there may be a loss of organic matter on portions of some new landings and the first few hundred feet of main skid roads However, these loses would be offset by integrated design features (appendix A) to incorporate slash from harvesting over landings and skid roads. Where losses occurred, it is expected that they would be within the Lassen Forest Plan soil standard.

The loss of some large woody debris would be anticipated due to volatilization during underburning. In the long-term, snag recruitment would moderate this loss. Integrated design features would also offset this loss by requiring an average of 10-20 tons of coarse woody material per acre where available (see appendix A).

Overall, the impact of overstory removal would be to increase canopy light penetration and reduce transpiration resulting in increased understory productivity and diversity. Increased understory productivity would result in increased rates of decomposition and soil organic matter accumulation.

Impact Indicator 2 - Erosion Potential

Maximum erosion hazard for soils in the project area are predominantly low to moderate throughout the project area (Table 98; Figure 27). However, several areas have high or very high erosion hazard risk ratings. Map Units 25, 37, 59, 60, 85, 92, and 131 (all with high or very high erosion hazard rating) overlap with proposed treatments. In these areas, steep slopes combined with sandy soils result in high erosion hazards when subjected to management treatments. However to mitigate potential risks, integrated design features limit the operation of mechanical treatments to slopes less than 35 percent (and less than 20 percent in RHCAs), and provide stringent guidelines for maintaining ground cover. These actions would decrease the erosion potential below a level of resource concern. Loss of soil organic matter from landings and skid trails is discussed above in indicator 1.

Impact Indicator 3 - Compaction Potential

In any thinning operation there is potential for soil compaction through a loss of soil porosity caused by heavy machinery. Landings and skid trails incur the greatest soil compaction risk. In the Creeks II project area, high clay content in near surface soils combined with a high degree of mesic (moderately moist) soils puts a large proportion of soil surface area in the Creeks II project area at high risk of detrimental compaction by heavy machinery operations (Table 98; Figure 27). Many of these soils are characteristic of riparian areas and as such are protected by integrated design features relative to RHCAs that impose limitations on mechanical activities within RHCAs (appendix A). The application of integrated design features, particularly operating when soils are dry and have high strength to resist compactive forces, would mitigate the potential for porosity loss (Alexander and Puff 1985). Operations are designed such that less than 15 percent of the area dedicated to growing vegetation would potentially be detrimentally disturbed. Landings, skid trails and other compacted areas would potentially restore porosity in the long-term through soil mixing from plant roots and microbial activity.

Impact Indicator 4 - Impacts to Hydrologic Functionality

Increases in understory productivity (described above) would lead to increasing soil particle surface area and cation exchange capacity in turn, enhancing the water- and nutrient-holding capacity of soils. This feedback cycle would lead to long-term continued increases in herbaceous productivity.

Impact Indicator 5 - Impacts to Soil Buffering Capacity

Reductions in basal area associated with the action alternatives would result in benefits to the soil buffering capacity. These benefits would depend on the degree of the response of the understory community and would likely follow a gradient of increasing basal area removal with the highest amounts of basal area removal related to the highest understory vegetative recovery. By increasing productivity and diversity of the understory, substrate diversity available for microbial metabolism would also increase. This, in turn, would increase the diversity of soil micro- (bacteria and fungi), and macro- (invertebrates) organisms. The result would be an increase in resiliency to disturbance of soil processes mediated by the soil organisms (i.e. nutrient cycling, carbon cycling and storage, trophic interactions).

Impact Indicator 6 - Carbon Sequestration Potential

The direct effects of mechanical thinning and fuels reduction treatments include an initial reduction in carbon stocks through biomass removal. However, decreased competition would result in increased net primary productivity in the remaining trees such that ecosystem level productivity would be either maintained or enhanced (Kaye et al. 2005, Sabo et al. 2008). Furthermore, it has been shown that reduced competition results in a greater amount of carbon being allocated to wood rather than leaves, resulting in a longer carbon residence time in biomass (Sabo et al. 2008). The action alternatives would result in decreasing forest susceptibility to stand replacing wildfire which increases the long-term potential of the forest to sequester carbon compared to the risk of stand replacing fire under the no-action alternative. Additional discussion of potential effects to carbon sequestration is described in the soil resources report (planning record).

Cumulative Effects

Cumulative effects to the soil resource were assessed for the Creeks II project area. This area was used as the boundary to assess cumulative effects because this area will be the only area within which proposed actions will have likelihood of contributing to soil cumulative effects. The interpretation of cumulative effects includes the effects on the soil resource of past, present and future actions within the project boundary. A detailed description of past, ongoing and reasonably foreseeable future actions are included in appendix E.

The current soil conditions, as outlined in the affected environment section above, are within standards established by Lassen National Forest. The implementation of integrated design features (appendix A) established to protect the soil resource would ensure that action alternatives would not result in significant detrimental cumulative effects to the soil resource and would be consistent with forest soil standards.

Range

Introduction

The Creeks II project area is located within the boundaries of four allotments on the Almanor Ranger District including portions of Butt Creek, Soda Creek/North Butte, Soldier Meadows, and West Humbug Allotments. The Soda Creek/North Butte is active and the other three allotments are closed or vacant. This analysis will focus on management direction, current conditions, and environmental consequences of proposed alternatives within the four allotments. The allotments are shown on Figure 29. Additional maps showing allotment improvements are located in the range resources report in the planning record.

Management Direction and Laws

The guidance for rangeland management is provided in the 1993 Lassen Forest Plan as amended, Rescission Act of 1995 Allotment Schedules (1996), 1999 HFQLG ROD, and 2004 SNFPA ROD.

Currently the identified suitable acres within the allotments include portions of primary range, which mainly consists of meadows interspersed with dense fir and pine stands. The Lassen Forest Plan, as amended in 2004, assigns the land allocation for these suitable acres as Riparian Habitat Conservation Areas (RHCA). The overall RHCA objective from the Lassen Forest Plan is to protect and restore desired conditions of aquatic, riparian, and meadow ecosystems; and provide for the viability of species associated with those ecosystems. The RHCA (#5) objectives that are incorporated into the Forest Plan are listed in the (ROD, pg A-33) and broad scale RHCA desired conditions pertaining to rangeland management are listed in the (ROD pg A-42-43).

Allotment specific desired conditions are also addressed in current monitoring plans, which are developed to include the measuring of attributes pertaining to hydrologic function, riparian habitats and indicator plant species, meadow and upland condition, as well as other resource values and programs.

Allotment Management Plans - The allotment management plans for active allotments are being revised as site-specific National Environmental Policy Act (NEPA) analysis is completed, as scheduled according to the Rescission Act of 1995 (Public Law 104-19, Section 504). The allotment management plans are being revised in accordance with FSM 2210 and upon completion of the scheduled NEPA analysis and decisions, terms and conditions of existing grazing permits may be modified or re-issued, if necessary to conform to such NEPA analysis.

Analysis for Soda Creek/North Butte Allotment was completed in 2009 and a revised allotment management plan was also approved in 2009. The allotment management plans for Butt Creek and Soldier Meadows were revised in 2006 based on the allotments being retained in closed status. Closed or vacant allotments are also expected to be re-evaluated during the Lassen Forest Plan revision.

Methodology

The bounds of analysis for the range resources discussion will consider the Butt Creek, Soda Creek/North Butte, Soldier Meadows, and West Humbug Allotments, as shown in Figure 29, because these allotments overlap the Creeks II project area. Surrounding allotments including Chips Creek, Butte Meadows, and Coon Hollow Allotments were not included because they are closed or vacant. Deer Creek Allotment was not included because the livestock use area is separated from the Creeks II project area by distance and Highway 32.

The measurement indicators used for this analysis include: forage availability, distribution of livestock, range improvements, and permittee/range management access.

Current grazing management on the allotments is described in the affected environment. Use of active allotments is authorized under a grazing permit from the Forest Service. Permittees may graze livestock within the allotment boundary as well as privately owned or controlled areas.

Incomplete and Unavailable Information

As mentioned above, the allotment management plans for Butt Creek and Soldier Meadows were revised in 2006 based on the allotments being retained in closed status. Analysis has not been completed on West Humbug Allotment. All closed or vacant allotments are expected to be re-evaluated during the Lassen Forest Plan revision which is scheduled for completion in the next few years.

Spatial and Temporal Context for Effects Analysis

The analysis area for cumulative watershed effects on the Creeks II project area includes ten subwatersheds. These subwatersheds either drain into either the Butt Creek or the Yellow Creek 5th field watersheds, which ultimately flow into the North Fork Feather River. The subwatersheds were created specifically for effects analysis on the Lassen National Forest and are between 5,000 and 11,000 thousand acres. They cover a total of 74,000 acres.

These subwatersheds encompass portions of four allotments (Butt Creek, Soldier Meadows, Soda Creek/North Butte, and West Humbug) and the cumulative effects area will be those allotment boundaries which overlay the Creeks II project area.

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

Several range improvement projects (fences) are in the process of being implemented on Soda Creek/North Butte Allotment as described in the 2009 allotment management plan. Several range improvement projects are also in the process of being evaluated for removal as described in the Butt Creek and Soldier Meadows 2006 allotment management plans (see appendix C).

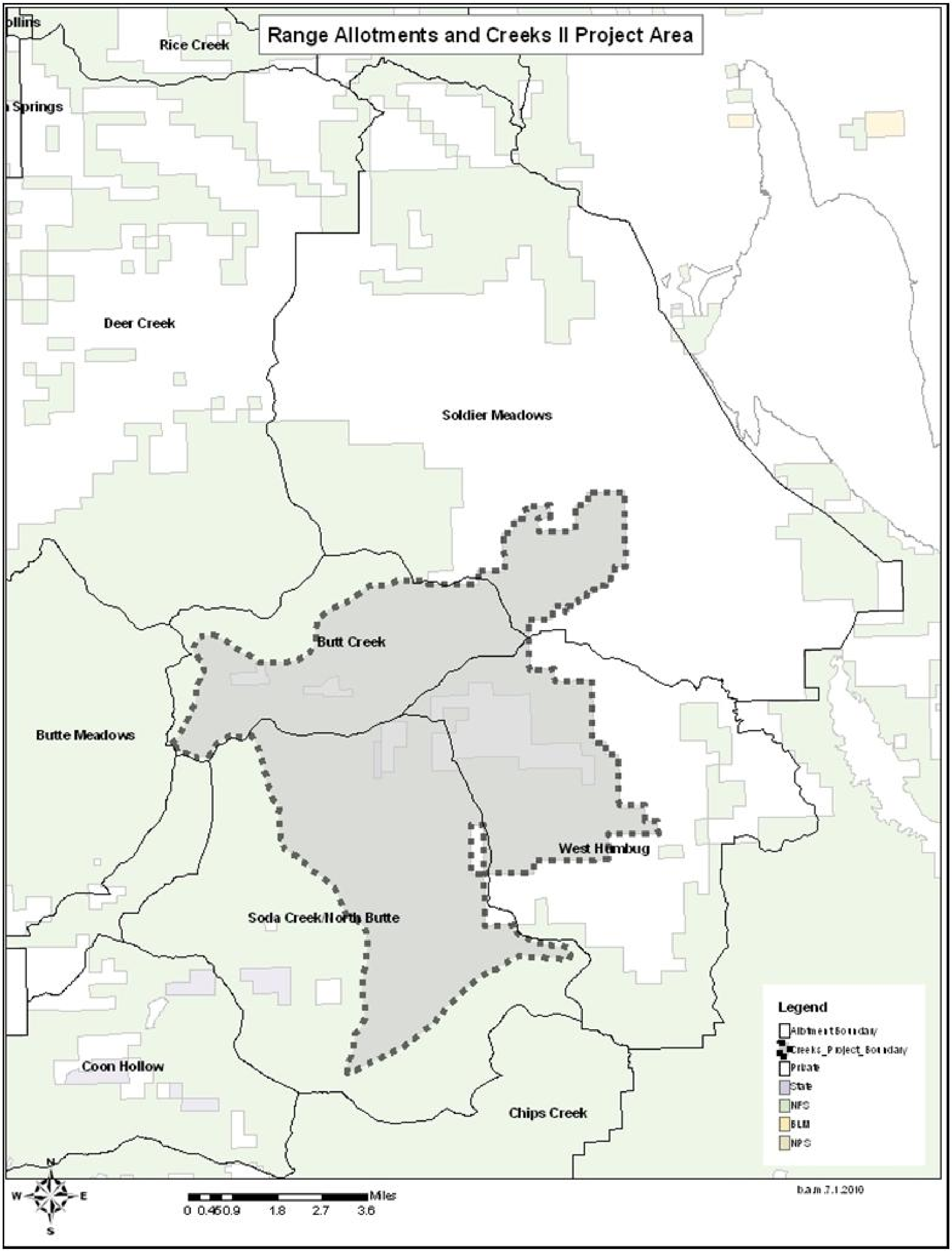


Figure 29. Allotment map 1

Affected Environment

Existing Condition

Presently the Soda Creek/North Butte Allotment is the only active allotment of four allotments that are located within the Creeks II project area, as shown in Table 99. Approximately 59 percent of the acres of Creeks II project area lie within vacant or closed grazing areas. The closed or vacant allotments are further described in the range report in the planning record. Within the one active allotment (Soda Creek/North Butte), a large portion of the area is considered non-capable for livestock grazing due to steep topography, dense timber stands, or distance from water.

Key areas have been established on each allotment which are monitored to ensure standards and guidelines are being met and to provide a basis for any necessary adjustments in allotment management. These areas are generally comprised of meadows or openings with herbaceous riparian vegetation such as Nebraska sedge (*Carex nebrascensis*), and other forbs and grasses. The key areas within the Creeks II project area are generally in satisfactory rangeland condition with the exception of some areas within vacant/closed allotments as mentioned above. Maps of key areas are located in the range resources report in the planning record. Monitoring data collected from key areas is filed at the Almanor District Office.

Table 99. Allotments within Creeks II project area

Allotment Name and Number	Status	Allotment Acreage (NFS lands)	% within Project (MPA) (approx.)
Butt Creek (#09)	Closed	11,281	25%
Soldier Meadows (#52)	Closed	17,330	10%
Soda Creek/North Butte (#51)	Active	27,267	41%
West Humbug (#58)	Vacant	11378	24%
Balance		**67,256**	**8,088 (100%)**

Allotment acreage determined by GIS coverages, % within MPA estimated

Active Allotments

Soda Creek North/Butte Allotment: Approximately forty-one percent of the acres of Creeks II project area lie within the Soda Creek/North Butte Allotment, within the eastern Soda Creek Unit (#51A-1). The allotment is active and under the current term permit, the permittee is authorized to place approximately 54 cow/calf pairs on the allotment under the provisions of an on/off permit from 6/16 to 9/15, or 218 animal month units per year on both the private and forest service administrated lands.

There are three range improvements on the allotment with permittee maintenance responsibilities, two of which are in Soda Creek Unit 51A-1 which lies in the Creeks II project area, including the Ben John fence and the LT fence. The Cold Springs water development lies outside of Soda Creek Unit 51A-1 and there are several structures and fences on private lands. The permittees maintain an allotment headquarters on private land at Little Grizzly Valley and derive their primary income from their livestock operations and other agricultural related activities.

Key areas monitored in Soda Creek Unit 51A-1 within the Creeks II project area under current management include Little Grizzly, Milkhouse Flat, Ben John, Yellow Creek, and LT Creek. Of the acres of National Forest System lands on this allotment, 15 percent are considered capable for livestock grazing, consisting of primary and secondary range acres mapped during range analysis.

During the last several years, the Soda Creek/North Butte Allotment has remained in compliance with permit terms and conditions and Lassen Forest Plan standards and guidelines. Management of the allotment has been adapted to address riparian concerns by applying a grazing system keyed to moving livestock with the use of fenced pastures and a low stocking rate. The permittee spends a substantial amount of time on the allotment moving livestock and the key areas have generally had acceptable levels of forage utilization.

Table 100. Permitted livestock numbers and seasons

Allotment Name	Livestock Class	Livestock Number	Season of Use
Soda Creek/North Butte	Cattle, Cow/calf	27 on NFS (50%) 27 off pvt. (50%) 54 total	6/16 to 9/15

Environmental Consequences

Direct and Indirect Effects

Alternative 1 No-action

No overall short-term impact to range resources is expected. Current grazing practices would continue on active allotments under the no-action alternative. Livestock grazing would continue to be managed and authorized under current operational direction and management plans. Current grazing management on the allotments is described in the affected environment. There would be no risk of damaging range improvements in allotments and no short-term negative effects to the permittee that might occur from possible deferments.

There would be no treatment of forested stands (i.e. thinning, burning), resulting in no increase in forage availability, no improvement to livestock distribution, and no long-term protection of range improvements.

Long-term effects may result in a reduction in forage availability and distribution of livestock due to increased plant competition from overstory shading, resulting in fewer areas within allotments for livestock to feed.

Existing range improvements (e.g. spring developments, fence lines, etc.) would require normal maintenance. Some increases in maintenance costs may be incurred as standing dead trees (snags) and unhealthy trees begin to fall and obstruct fence lines, spring developments, and salt grounds.

No aspen treatments would take place within the project area and post treatment protection measures would not be implemented as part of this project.

A potential adverse impact to grazing as a result of not implementing the project could come from a wildland fire. Treatment of the fuel condition to reduce the risk and hazard associated with a wildland fire would not be implemented making the area vulnerable to loss of soil and water quality, should a wildland fire occur.

Alternative 2-4

Effects from alternatives 2-4 would be similar except for the reduction and change in the type of the treatments under alternatives 3 and 4. Under alternatives 2-4, grazing on the active Soda Creek/North

Butte Allotment is expected to continue at current levels. Impacts from these alternatives would be minimal to the vacant/closed allotments.

Treatments may positively affect both the short- and long-term range conditions by reducing conifer density in stands, reducing ground fuel loading that restricts livestock movement, and increasing transitory range forage. The proposed treatments would have a positive effect on range conditions and increase available forage for livestock.

There could be a temporary loss of forage during the treatment recovery period due to activities that may cause displacement for livestock. During the recovery period, grazing management practices would be implemented to achieve desired use levels. Practice may include deferment, adjustment of pasture management, placement of salt blocks, or other management practices that would promote use by livestock away from treatment areas if needed. Grazing management adjustments would be developed in coordination with the permittee and incorporated into active permits and allotment management plans.

Most grazing areas occur outside of forested areas and reductions in grazing use are not anticipated. Potential costs associated for any additional moving of cattle away or out of the project area are unknown.

Maintenance of range improvements could be increased in the event of damage caused by project activities. Two fences within the Soda Creek Unit would not likely be affected. Fences within vacant allotments are in the process of being evaluated for removal. Fences bordering private lands at Little Grizzly Valley (Soda Creek/North Butte Allotment), and the Ruffa Ranches (Butt Creek Allotment) are located in the vicinity of proposed project activities, and these improvements would need to be avoided. Roads (some of which contain cattleguards) used for the project would receive maintenance as described in the transportation section.

Access to monitoring areas within the allotments would be continued, including key areas with existing study plots and transects. Most of these sites are in riparian areas and would not be affected. If project activities did come close to a study area, transects would be marked with items such as T-posts, cages, rebar with yellow caps, painted posts etc., and these areas would be avoided.

Project activities involving roads could affect the livestock operation although alternative roads or trails may be available if periodic or temporary closures are needed. Road decommissioning areas are not known to be in primary range areas or needed for allotment management. Permittee travel related authorization to conduct permitted activities using off-highway vehicles (OHV), including removal of dead livestock and/or construction and maintenance of range improvements would continue to be reviewed and approved annually in the annual operating instructions.

There could be a risk of vehicle collisions or other incidents with livestock during project activities. Contract safety specifications would reduce the risk of incidents, and the quality of the roads would also reduce a vehicle’s travel speed, thus minimizing the risk of livestock collision. Coordination with the permittee in advance and signing along Forest system roads to alert the public to potential hazards would also help reduce incidents.

Long-term availability of forage could be increased due to reduced competition from shrubs and trees, increased soil nutrient availability, and increased sunlight as a result of treatments. Forage production and accessibility could be increased on up to approximately 10,600 acres within the allotments, and new areas of transitory range could be created which could improve livestock distribution and use patterns.

Some key areas within Soda Creek/North Butte Allotment would be in the vicinity of treatment areas and livestock distribution could potentially change or expand as treatments reduce dead and downed woody material and if transitory range is created. Treatments are also planned in the vicinity of trailing routes and fenced pasture areas within the allotment. Monitoring of grazing standards and guidelines would be continued as described in allotment management plans.

Long-term maintenance costs could be reduced to some range improvements as forest health is improved, resulting in less downfall near fences, water sources, or salting areas. Fences bordering private lands in the vicinity of proposed project activities include Little Grizzly Valley, (Soda Creek/North Butte Allotment) and the Ruffa Ranches (Butt Creek Allotment).

Livestock could potentially graze or trample regenerating conifer stands, but effects are expected to be minimal since primary range would continue be available within the Soda Creek/North Butte Allotment. Regeneration treatments would be monitored for livestock impacts.

Livestock impacts to treated aspen areas are anticipated to be short term in duration, since young aspen should grow above the browse level within 3-5 years. Young aspen would be monitored and if needed, protective barriers or temporary fence could be installed in active allotments to allow aspen to release to an adequate size. Any new range fences would be planned separately from this project and exact locations and designs of new improvements would be determined later in a site-specific NEPA document.

If needed, the standard and guideline to defer livestock grazing on perennial rangelands may be required, for two growing seasons after burning to allow desirable plants to establish. On the active Soda Creek/North Butte Allotment, the permittees frequently move and distribute livestock throughout key areas and some are also kept within fenced areas during a portion of the season. Deferred use is not expected to be necessary. If required, this change could result in an inconvenience or economic loss to the permittees if they were required to find other areas to graze cattle or reduce numbers during a deferment period.

Cumulative Effects

Livestock grazing on the allotments has occurred in variety of forms since the early 1900s and numerous grazing systems have been implemented along with accompanying range improvements. Presently, grazing levels are at their lowest point when compared to historic levels. The livestock industry as a whole has seen decreases in permitted use on federal lands due to a variety of factors. Some grazing operations may be at risk of falling below the minimum level of continuing a feasible operation due to fluctuations in livestock commodity prices, overhead costs for producers, and the consumer marketplace.

Private lands associated with allotments have been grazed for many years and Lassen Forest Plan standards are not applied to these areas. Grazing of private lands within the Creeks II project area is expected to continue.

Previous vegetation management projects may have provided, or are providing, transitory grazing opportunities for livestock where more open forest habitat was created. Some of these openings may be isolated areas of non-capable range. Active allotments have not been reliant on transitory rangelands and previous projects have not resulted in major changes in grazing use.

Currently most livestock grazing takes place outside proposed treatment areas, and alternative grazing areas continue to be available. The long-term treatment effects of implementing alternatives 2, 3 or 4 would be positive for range resources by increasing forage quality, quantity, and distribution of livestock within allotments. Future planned projects in these allotments in the next decade could have a positive effect on all range resources, with negligible cumulative effects.

Wildfire such as the Storrie Fire occurred in portions of the West Humbug and Soda Creek/North Butte Allotments, and fire suppression activities (controlled burning) extended into the area surrounding the Ben John key area. The cumulative effect of past and ongoing (on private lands) fire rehabilitation-salvage/planting within the allotments is a temporary increase in foraging areas and improved access for livestock. These openings have not received additional fuels reduction treatments and in some areas surface dead material is increasing. Low and/or discontinued use of grazing allotments may result in a relatively minor accumulation of fine fuels in the form of cured grasses and forbs in the project area. Livestock management activities would be comparable to current operations.

The potential maintenance of the DFPZs created by the Creeks II project is a reasonably foreseeable action. This maintenance could allow for openings or transitory range to be continued, since maintenance of the DFPZs would be achieved with fire and thinning. Other projects in planning stages could include areas near the Creeks II project which could eventually encompass a larger area in and around the Soda Creek/North Butte Allotment.

Higher livestock numbers on these ranges in the past may have resulted in higher long-term utilization levels, influencing the range and watershed conditions at a landscape level. The cumulative effects of potential additional compaction through project activities and grazing are expected to be minimal since only one out of the four allotments is active, livestock use generally occurs on meadows and riparian stringers which are managed to attain Forest Plan standards and guidelines.

Livestock in the Creeks II project area may also contribute to the risk for spreading exotic plant and noxious weed invasions, as discussed in the noxious weed risk assessment (planning record). The cumulative effects of continued existing grazing and project activities is potential additional weed spread, although integrated design features for noxious weeds would minimize the risk (see appendix A).

Livestock grazing in the active allotments may continue to have a lowered amount of available forage for some wildlife species. Livestock grazing may influence habitat suitability, including willow flycatcher habitat.

Recreation trails include the Pacific Crest Trail in two locations and several others. Portions of these trails overlap livestock use areas on the active allotment and permittees contribute to trail maintenance. Impacts from livestock, vehicles, OHV, and recreational stock along numerous roads and trails may cumulatively contribute to surface disturbance and exotic plant spread. The level of recreational use within the forest including the Creeks II project area is expected to increase and the cumulative effects of continued existing grazing and project activities is a potential of increased use and impacts to trails.

At this time there are no existing plans to expand these allotments or increase the numbers of permitted animals on any allotment. With implementation of alternatives 2-4, trend in range condition on the allotments is anticipated to remain static overall, with an upward trend anticipated on vacant allotments and static or slight upward trend on active allotments managed to meet Forest Standards and Guidelines.

Heritage

Introduction

An analysis of cultural resources was conducted for the Creeks II project to determine if historic properties were present within the project boundary, and if such properties would be affected by project actions. The Creeks II area has shown a long history of occupation and use by early prehistoric populations, later Maidu occupants and Euro-American populations over the past 5,000 years.

This high elevation area was used by Native populations primarily in summer months for the acquisition of diverse food resources as well as needed materials. The numerous basalt quarries found in this area have been used to secure raw material for tool making by prehistoric populations for thousands of years. Many task sites have been recorded on the landscape indicative of hunting, food processing and tool making activities. Occupation sites are generally located in adjacent valleys. Euro-American diffusion into this area in the mid 1840s drastically effected the Native populations and their way of life.

The 1849 gold rush in California brought many immigrants from the East over the Lassen trail located just north of the project area on their way to the Sacramento Valley and the gold fields. Population centers in the valley grew (Oroville, Chico) and wagon road systems (Humbug and Humboldt roads) were constructed in the mid 1850s to 1860s to provide access to the high country and the Idaho mines beyond. Small mountain communities and stage stops began springing up along the wagon road routes. Valley ranchers utilized mountain pastures in the summer to provide food for their stock; a practice which continues today on private pastures and Forest Service range allotments. Valley settlements had an insatiable need for building materials and logging of the vast low elevation timber stands began circa 1860. A variety of logging practices were utilized over the next 70 years, chasing timber into less accessible, high elevation mountain lands, culminating in railroad logging by the Red River Logging Company into the early 1930s.

The Lassen National Forest, established in 1905, began managing public lands for such things as grazing and timber harvests. By the 1920s, recreation had become an important emphasis for the Forest Service which resulted in the development of many recreation residence tracts and later public campgrounds during the 1930s and subsequent years. The diverse array of heritage sites identified within the Creeks II project area reflects the past historic and prehistoric events discussed above.

Management Direction and Laws

Alternatives 2-4 are in compliance with the Forest Plan and other regulatory direction, and would prescribe standard resource protection measures for all historic properties and would lessen the effect of wildfire and subsequent suppression activities on historic properties through thinning and fuels reduction. The heritage inventory, documentation and site protection measures meet current standards, direction and regulations, stipulated in the NHPA, Regional PA, Interim Protocol, Federal regulations (36CFR800), and the Lassen Forest Plan.

This analysis is in conformance with regulations of the National Historic Preservation Act (NHPA), 1966, as amended (P.L. 89-665, 80 Stat.915); the National Environmental Protection Act (1969), Archaeological Resources Protection Act of 1979 (ARPA), Native American Grave Protection and Repatriation Act (1990: P.L. 101-601), and American Indian Religious Freedom Act (1978: P.L. 95-341), and as called for by the 1996 First Amended Regional Programmatic Agreement Among the U.S.D.A. Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council On Historic Preservation Regarding the Process For Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region (USDA—RPA 1996), and the 2004 Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects (Interim Protocol--USDA 2004).

The National Historic Preservation Act requires federal agencies to consider the effects of their undertakings on historic properties. The term historic properties refer to Class I cultural properties that have been listed or qualify for listing on the National Register of Historic Places. Section 106 of the National Historic Preservation Act as well as Federal implementing regulations (36 CFR 800) outline specific procedures federal agencies must follow before implementing an action (undertaking) that may affect historic properties. For the purpose of this analysis, unevaluated properties are considered Class II properties and are treated as potentially eligible for listing on the National Register eligibility. Class II properties will be afforded the same protective status as historic properties (Class I). Class III properties are those sites that have been evaluated and found not eligible for listing on the National Register of Historic Places. Such sites generally do not require further protection or mitigation.

Methodology

Analysis Methods

In order to gain an understanding of what was known about the history of the Creeks II area and gather specific knowledge of the probable location of cultural resources, an extensive background research effort of relevant literature was conducted at local and state libraries and archives. Historic Government Land Office (GLO) maps as well as the associated survey notes for the project area were also reviewed. Early aerial photographs were inspected to assist with the location of linear features such as historic roads, trails, ditches, railroad alignments and the location of features shown on GLO maps. Lassen National Forest GIS heritage layers provided locational information on heritage sites within the area of potential effect, the Forest lands previously inventoried, and those lands still requiring investigation. Almanor District Heritage files, which contain information pertaining to the prehistory and history of the project area, were reviewed including all pertinent archaeological reconnaissance reports, site records and oral interviews.

The Lassen National Forest Land and Resource Management Plan (USDA Forest Service 1993) objectives and Forest-wide standards and guidelines are designed to ensure protection of heritage sites. The USDA Forest Service (Region 5), the California State Historic Preservation Officer and the Advisory Council developed a standard set of guidelines, the Regional Programmatic Agreement and Section 106 Compliance, for the identification, recording, evaluation, protection and treatment of heritage resources on National Forest System lands.

Accordingly, additional surveys were conducted (Kent 2004, Moore 2006 and Barton 2007) to identify, and record heritage resources, and ultimately, determine if proposed project actions would adversely affect such resources. The survey coverage used was adequate for the purpose of identifying historic properties and satisfied stipulations in the Regional Programmatic Agreement for intensive survey. New sites were recorded using standard Department of Parks and Recreation forms which included the Primary, Archaeological and Linear site record forms. The surface extent of each site was mapped and the boundary established using Global Positioning System (GPS). Linear sites such as the original segments of historic roads were also mapped using GPS and the new GPS site location data and survey coverage data collected during the Creeks II inventory was added to the Lassen National Forest Heritage layers.

The review of previously recorded sites within the Creeks project made it clear that many sites, identified decades ago, were not recorded to standards used today. As required by the Regional Programmatic Agreement, these sites were re-recorded to current acceptable standards. Background research also noted that many previously recorded sites had not been visited in many years and as a result, monitoring was conducted to establish a base line condition of these sites and document previous effects.

The protection of numerous heritage sites using standard resource protection measures appeared tenuous at best due to the large number of sites and numerous project-related conflicts. These problematic sites were subsequently evaluated for eligibility to the National Register of Historic Places pursuant to the National Historic Preservation Act and Regional Programmatic Agreement (Bevill et.al. 2008, Black 2008); eligibility was determined in consultation with the State Historic Preservation Officer (SHPO).

Scope of Analysis

The heritage analysis for the Creeks II project focused on the area defined by the Creeks II project boundary. Proposed treatment and activity areas and all other National Forest System lands within the project boundary comprised the heritage analysis area. A mixed strategy was used to analyze known information and to gather additional information needed for the analysis of Creeks II area of potential effect. This effort entailed the review of existing heritage information for the area, followed by gathering supplemental information needed for analysis through field inventory, site monitoring and site evaluations. Finally, each project alternative was assessed to determine effects on heritage properties. Scoping was conducted for this project to determine if interested public or tribal parties or entities had specific knowledge or concerns about cultural resources that may be affected by project activities. No concerns were identified.

Affected Environment

Existing Condition

All lands within the area of potential effect for the Creeks II project have been inventoried for heritage resources and the results of these efforts have been documented in numerous archaeological reconnaissance reports (Refer to Table 1 of the heritage report in the planning record for a list of past surveys). Past and current surveys have identified 105 heritage sites within the area of potential affect for the proposed Creeks II project. Twenty-seven of these sites are historic resources which consist primarily of refuse scatters, trash dumps and camps, wagon roads, railroad alignments, historic trails and mining ditches. The majority of cultural resources identified within this area are prehistoric sites (Table 101). These sites range from small, sparse lithic scatters to large, dense scatters with a variety of debitage as well as a diversity of prehistoric tools. In addition, numerous prehistoric basalt quarries have been identified along with several processing sites exhibiting bedrock milling features and ground stone implements. Ten multi-component sites, comprising historic and prehistoric components, were also identified within the area of potential effect (Table 101).

Table 101. Breakdown of site type and status

Site Type	Number	National Register Status[a]		
		E	NE	PE
Prehistoric	68	3	7	59
Historic	27	1	6	19
Multi-component	10	--	4	6

a - E=Eligible, NE=Not Eligible, PE= Potentially Eligible

Site condition monitoring has been completed for about twenty percent of the heritage properties identified within the project area. The purpose of this monitoring effort was to establish baseline conditions, determine past effects and to re-record sites to current standards. Monitoring results have shown that a great majority of sites suffered damage from a variety of previous logging activities, fire suppression activities, recreation use or access, and erosion. Evidence of logging effects was found at almost every site monitored. Much of this damage was caused by past logging efforts (pre-1975) as noted in early site records. However, many sites have been impacted after laws were enacted to protect sites on Federal lands.

Twenty sites identified within this project have been evaluated for eligibility to the National Register of Historic Places. In consultation with the State Historic Preservation Office, three heritage sites were determined eligible and seventeen determined ineligible for listing on the National Register of Historic

Places (National Register). The remaining sites that have not been evaluated for the National Register are considered potentially eligible properties (Class II properties) until eligibility determinations are completed. The Lassen Trail has been designated as a National Historic Trail and as such will be treated by the Lassen National Forest as a National Register eligible property. Four National Register eligible and 84 potentially eligible properties will be afforded protection from all project-related activities.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 No-action

The no-action alternative will not cause any direct environmental effects to the eighty-four protected historic properties identified within the Creeks II project area of potential effect, as no activities are planned.

Indirect effects may occur under this alternative as there are numerous historic properties in the area that could be affected by high-intensity wildfire. Severe fire intensity has been shown to damage and destroy surface artifacts and lessen the data potential of surface sites. The lack of surface vegetation, resulting from a high intensity wildfire, could cause destructive erosion of surface and subsurface archaeological deposits and increase site visibility which could lead to increased instances of looting.

Alternative 2 and 3

These alternatives propose to create and maintain late-seral attributes and vegetative heterogeneity; reduce conifer and stand densities; reduce potential for catastrophic wildfires and provide safe conditions for fire fighters; enhance aspen stands, water quality and improve conditions in RHCAs.

About half of the historic properties identified in the project area of potential effect are found within or adjacent to treatment areas or other activity areas (road construction/reconstruction, decommissioning, landings etc). These sites could be adversely affected by the many planned project activities due to their location, however, implementation of standard resource protection measures and district protection protocols discussed below should mitigate any direct effects to these resources. The potential for finding new sites during project implementation always exists. Direct effects caused by any unanticipated discoveries will be mitigated using protocols stipulated in the Regional Programmatic Agreement.

Fuel reduction treatments would have an indirect beneficial effect on heritage resources, as the threat and occurrence of catastrophic wildfires that could adversely affect sites through suppression activities and high fire intensities, would be greatly reduced. Also reduced would be the potential of erosion events, expected after high intensity wildfires. The objectives within the proposed action and alternative 3 are designed to help reduce catastrophic wildfire conditions through DFPZ creation and fuels treatments. Other indirect effects are not expected to occur to known heritage resources as a result of alternative 2 or 3.

Alternative 4

This alternative proposes specific treatments that would lessen the chance of stand replacing catastrophic high intensity wildfires and provide fire fighters increased safety during suppression activities. With the exception of “no group selection or aspen treatment units”, alternative 4 is for the most part, the same as the proposed action and alternative 3. Refer to above effect discussions for alternative 2 and alternative 3.

Cumulative Effects—All Alternatives

The cumulative effects analysis boundary for Heritage resources is the project area of potential effect.

Approximately, half of the historic properties identified within the project area of potential effect are situated adjacent to or within planned treatment units and roads slated for modification. All of these resources will require protection from project-related activities pursuant to National Historic Preservation Act, the Regional Programmatic Agreement and Interim Protocols. A complete list of sites, their National Register status, project-related conflicts and protection measures is found in Table 3 of the heritage report, located in the planning record. Standard protection measures are also listed in appendix A of this EIS.

Past wildfires have affected heritage resources by consuming or adversely affecting prehistoric surface materials and historic structures, features and artifacts. Fire suppression activities have also had detrimental effects over the years to heritage properties, destroying or greatly altering the surface and subsurface context of numerous sites by the construction of fire control lines. The proposed action would create DFPZs, thin stands and reduce hazardous fuels which could have a beneficial cumulative effect on heritage resources by lessening the negative impacts of future wildfires and need for large scale suppression activities.

The greatest past threat to heritage sites in this area has been timber harvest operations and the numerous activities associated with logging. Many prehistoric sites were damaged by historic logging operations well before the enactment of federal preservation laws (1970s) as noted by early site records. After the enactment of the National Historic Preservation Act, timber harvest operations and road construction continued to impact sites well into the 1980s and beyond before federal laws and regulations were routinely implemented to protect these resources.

The Creeks II project should have no cumulative effect to heritage sites in this area upon implementation of the standard resource protection measures detailed above. The no-action alternative would have little environmental effect to historic properties in the Creeks II project area and as such would be in compliance with the Forest Plan and other regulatory direction.

Recreation

Introduction

The Record of Decision (ROD) for Motorized Travel Management on the Lassen National Forest was signed in January 2010. The selected alternative in this decision prohibits cross-country travel off of designated roads and trails except as allowed by permit or other authorization. The decision also identified routes that would be seasonally restricted to facilitate winter recreation (snowmobiling, cross country skiing). Routes within this project area are included in this decision. The Forest motorized vehicle use map shows routes open to motorized vehicle travel by vehicle type (all vehicles or highway-legal only) and season. Tier I routes needed no mitigations, so they were added to the 2010 motorized vehicle use map and route number signs were placed during the summer of 2010. Tier II routes require further safety and resource mitigations before they can be added to the National Forest Transportation System. They will be added to future versions of the motorized vehicle use map as the mitigations are accomplished. Mitigations may include monitoring, signing route boundaries, installing proper drainage or placing barriers to prevent motorized vehicle access into sensitive areas. Dispersed camping sites at Grizzly Creek and Yellow Creek will be affected because vehicular access to these sites will be restricted. Some routes will not be available for use until mitigation is complete. The Record of Decision (ROD) for Lassen National Forest Motorized Travel Management is hereby incorporated by reference.

Management Direction and Laws

All action alternatives are in compliance with the recreation opportunity spectrum classes found in the Lassen Forest Plan as amended.

Measurement Indicators

There are no purpose and need measurement indicators for recreation.

Affected Environment

The 2004 Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement and Record of Decision, includes a diverse analysis of recreation opportunities and data on economics, statistics and capacities for the Sierra Nevada National Forests including the Lassen National Forest. The listed activities are examined for the forest and address data including visitor days of use, expected increase in demand, and direct and indirect economic benefits. The largest recreation complex near the Creeks II project area is associated with the 75 square mile lake Almanor to the east. Lake recreation, fishing and water play activities are supported by public and private family and group campgrounds, boat launches and marina facilities and hiking, bicycling and equestrian trails.

Recreation use is important in the mix of resources provided by the Lassen National Forest. The 1992 Lassen Forest Plan states goals to provide a wide range of outdoor recreation, interpretive services and facilities, and diverse opportunities for off highway vehicle recreation and winter sports. The project area is located in two management areas: 45-Soda Ridge and 37-Butt Creek.

Management direction specifics for Soda Ridge management area related to trails includes:

- Continue to provide vehicle access to established trailheads within the Soda Ridge Management area (Sunflower Flat, Peacock Point, Belden and Indian Springs)
- Prevent motorized vehicle entry into recreation opportunity spectrum areas designated as semi-primitive non motorized within the Soda Creek drainage and special areas at Green Island Lake, Frog Lake, and Saucer Lake.
- Prohibit motorized cross country travel except as allowed by permit or other authorization.
- Prohibit wheeled vehicles on routes designated with seasonal restrictions for winter recreation (cross country ski, snowmobile) from December 26 through April 1 annually.

Management direction specifics for Butt Creek management area include:

- Maintain access to and protect existing trailheads for Pacific Crest National Scenic Trail (PCT)
- Develop and improve trailheads for the PCT at Humboldt Summit ,
- Interpret management activities along the PCT
- Manage for dispersed recreation use in all areas except Soldier Meadows campground which is managed as a moderate development (level 3) campground.
- Prohibit cross country travel except as allowed by permit or other authorization
- Prohibit wheeled vehicles on routes designated with seasonal restrictions for winter recreation (cross country ski, snowmobile) from December 26 through April 1 annually.

Recreation Opportunity Spectrum

The Lassen National Forest uses the Recreation Opportunity Spectrum (ROS) (USDA Forest Service 1986) to classify and manage recreation opportunities based on the physical setting, social setting, and managerial setting of the project area. The Creeks II project activities are located entirely in a roaded natural setting where resource modifications and utilization practices are evident but harmonize with the natural environment (Figure 30). This recreation opportunity is measured against the recreational uses within the project area. Since roaded natural allows for modifications to the resources, recreation users are accustomed to seeing the activities proposed in the Creeks II project.

Dispersed Recreation

Dispersed recreation accounts for the largest amount of recreation activity in the Creeks II project area; and is projected to increase (CA P&R 2002). During all seasons use is high, amounting to about 40 percent of total Lassen National Forest recreation. The most popular dispersed recreation activity is motorized use, followed by fishing, camping, hunting and hiking/walking.

In addition to these popular activities, other recreation uses include horseback riding, snowmobiling, OHV use, driving for pleasure/sightseeing, and forest products gathering. Winter snowmobile areas and designated summer OHV riding areas are funded in part through a partnership with the California Department of Parks and Recreation using a grant program for operation and maintenance of OHV trails and staging areas. Christmas tree cutting is popular, especially within the project area as there is an abundance of small “silvertips” (red fir) close to roads. Collecting mushrooms is another activity known to occur when conditions allow. Permits are required for gathering forest products but they are not a significant source of revenue. Within the project area, hunting is primarily associated with black-tailed deer, black bear and upland game (quail). Fishing occurs on most creeks within the project area. Yellow Creek has special fishing regulations; only artificial lures with barbless hooks may be used from Big Springs to the lower end of Humbug Valley. Butt, Grizzly and Soda Creeks also receive some fishing pressure during summer months within the project area.

Facilities for dispersed use within the project boundary are few and are generally focused on roads and trails. Two designated dispersed campsites (Little Grizzly and Yellow Creek) are used throughout the summer months and are heavily used during fall deer hunting season.

Developed Recreation

Developed recreation in the project area is minimal. Soldier Meadows Campground is a small campground (8 sites) in the northeast corner of the project area and is the only developed facility within the project boundary. Pacific Gas and Electric’s Yellow Creek campground is a moderately developed campground (20 sites) just east of the project area. The highest use period for both campgrounds coincides with the opening of fishing season in the spring and deer hunting season in the fall. Design features would not allow any project-related activity to occur within the posted recreation site boundaries, and all facilities would be protected.

Developed fee sites on the Lassen National Forest are administered under Federal Lands Recreation Enhancement Act and will remain so in the foreseeable future.

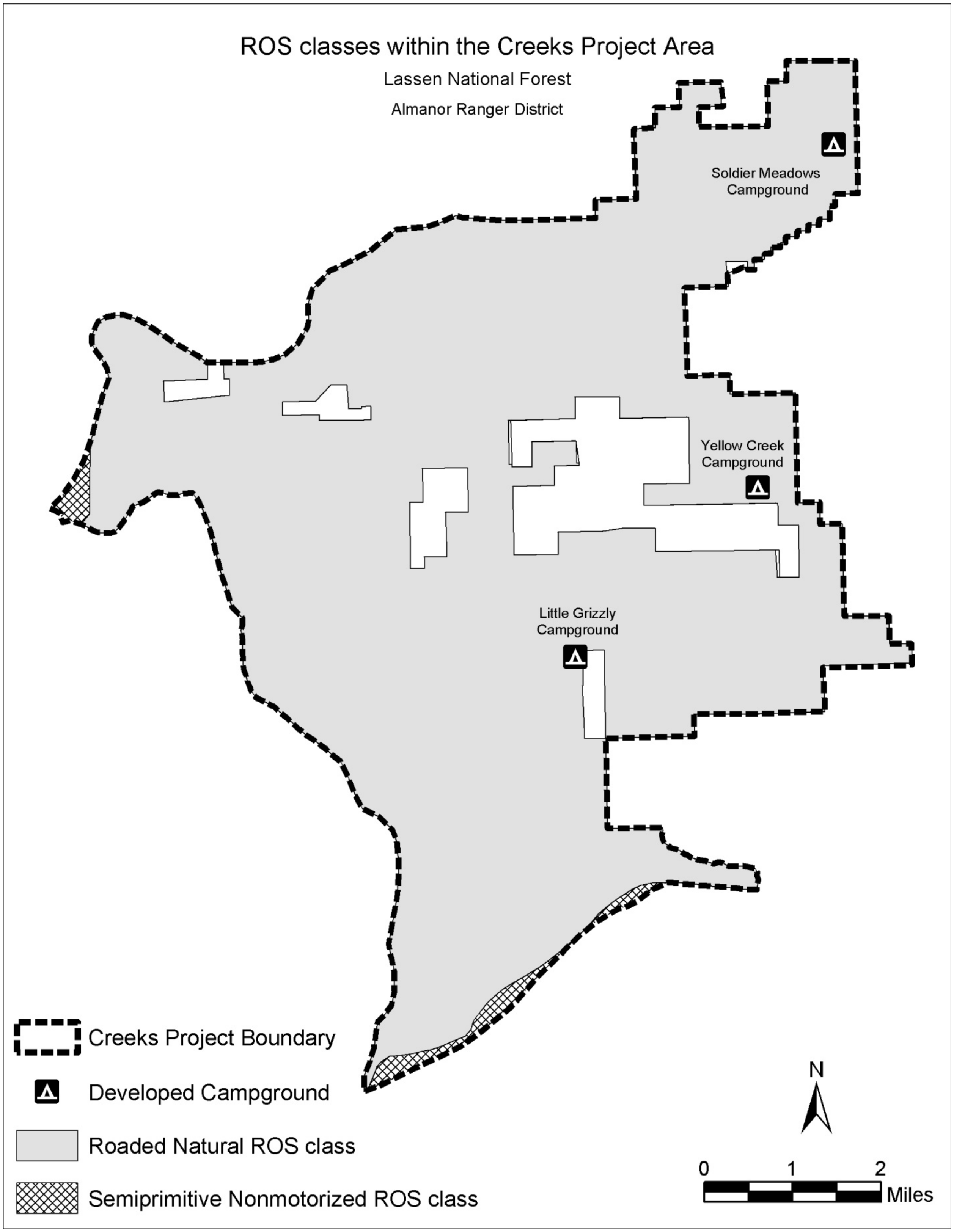
Trails

The most notable hiking trail within the project area is the Pacific Crest National Scenic Trail, which follows the west boundary of the project area for approximately 10-12 miles. This nationally acclaimed trail is 2,650 miles long extending from Mexico to Canada. The Humboldt Summit and Cold Springs (at Humbug Summit) trailheads provide access to the trail adjacent to the project boundary. The Cold Springs Trailhead at Humbug Summit provides hitching posts and a water trough for equestrian users. Other system hiking trails in or near the project area include the Soda Creek Trail and the Grizzly Creek Trail (currently not maintained). The Peacock Point and Sunflower Flat trailheads provide access to the Soda Creek Trail as well as Green Island Lake, Saucer Lake and Frog Lake. Green Island Lake is recommended as a research natural area for the bog vegetation type.

A portion of the Back Country Discovery Trail passes through the project area on Plumas County Road 307 (FS 27N11). Discovery Points depart from the main route and direct vehicular travelers to points of interest. The Back Country Discovery Trail was established to provide access to more remote areas of the “back country,” generally utilizing gravel and dirt roads and OHV trails with linkages to the Scenic Byways system. They are intended to enhance opportunities for quality outdoor recreation by providing a system of sport utility vehicle (SUV), high clearance and off-highway vehicle roads and trails throughout the forest. Some of these routes are not suitable for use by passenger cars.

Snowmobile use occurs within the project area. The majority of the Jonesville snowmobile trail system (60 miles of groomed trails) is within the project area. The trails are composed of Forest Service (27N04, 27N65, 26N02 and 26N35) and County roads (307 and 308) and are accessed either from State Highway 89 along the west shore of Lake Almanor or the Jonesville Winter OHV Staging Area on Humboldt Road north of Butte Meadows. Trail use consists mainly of individual and club riders. The Lassen National Forest Travel Management ROD (1/2010) established seasonal restrictions for wheeled vehicles on many of these routes between December 26 and April 1 annually.

Most access to recreation opportunities within the project area is via Plumas County Roads 307 and 308 from State Highway 89 to the northeast and via State Highway 32 via Butte Meadows and Humboldt Roads (308) to the southwest. Dispersed use occurs along all roads, as no barriers restrict access or use except those imposed by topography. Forest and County roads are generally in good condition. There are no contemporary counts of use on these roads.



Source: Almanor Ranger District GIS

Figure 30. Recreation opportunity spectrum (ROS) classes within the Creeks II project area

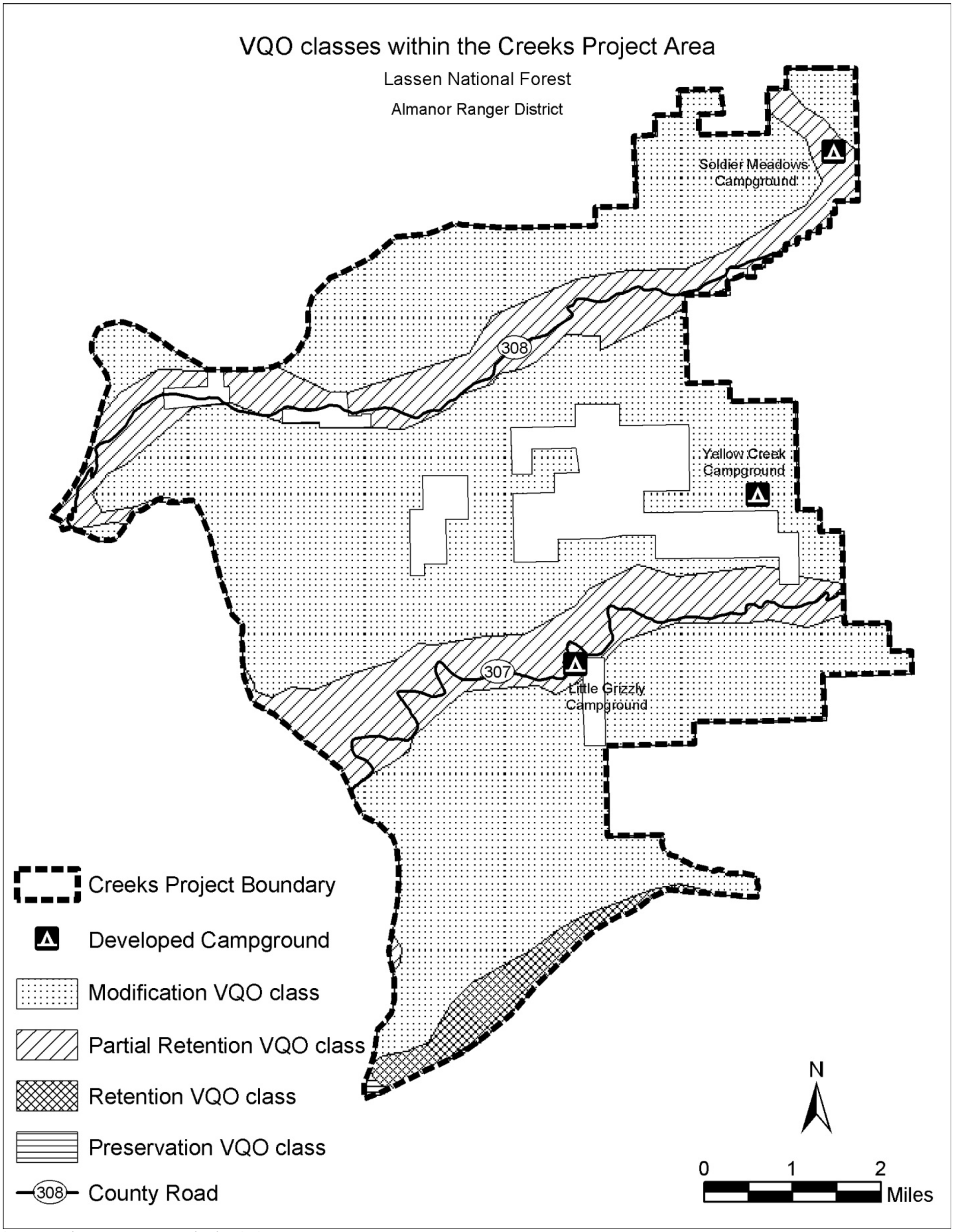
Visual Quality Objectives

The Lassen National Forest uses Visual Quality Management to classify visual resources. There are four visual quality objectives within the Creeks II project area: preservation, retention, partial retention, and modification. No activities are proposed within preservation or retention (Figure 31).

The majority of the project area is in the visual quality objective of modification, where activities in the foreground and middle ground are dominant, but appear natural. Two main corridors, one along Plumas County Road 307 and one along Plumas County Road 308, are in partial retention, where management activities should remain visually subordinate (USDA Forest Service 1973).

The existing landscape in the project area is natural appearing to the public as a mosaic of differing forest types, grassy meadows, and moderately uneven terrain. The project is in located in a Forest production/multiple use area with timber and recreation endeavors expected. Past fire disturbances are in part responsible for the mosaic appearance of the project area. Also, past timber harvests have occurred throughout the project area where in the age class of trees varies and some plantations of even age trees are scattered both with large amounts of undergrowth.

Portions of the existing roads and trails in the project area are effectively the viewing platforms, from which to analyze effects. Areas of high interest in visual quality are County Road 307 which is Back Country Discovery Trail, and County Road 308 to Humboldt Summit. The Pacific Crest Trail follows the west boundary of the project; and Soda Creek Trail and trailheads (Peacock Point and Sunflower Flat) and Soda Ridge (26N74) to the south. The Jonesville Snowmobile Area, which consists of three snowmobile touring loops following County and Forest roads, fall within or adjacent to the project boundary.



Source: Almanor Ranger District GIS

Figure 31. Visual quality objectives (VQO) classes within the Creeks II project area

Environmental Consequences

Alternative 1 – No-action

Direct and Indirect Effects

The no-action alternative would result in no immediate or foreseeable change to existing dispersed or developed recreation activities and visitors use of the roads and trails.

No action would result in no immediate, discernable change to the visual resource and little perceived change for years. If no disturbance events occur over the next 20 to 30 years, the mixed conifer and fir communities would continue to dominate the landscape and increase in density further reducing scenic variety and diversity. With no reduction in the risk of wildfire to this forest area, effects to the scenery would take place if a large-scale wildfire (beyond expected disturbance levels in this ecological unit) were to occur. Depending on the scale, wildfire could permanently change the vegetative composition of the forest resulting in scenic degradation for 3 to 10 years and a different type of scenic expression thereafter.

Cumulative Effects

With no reduction in the risk of wildfire to this forest area, effects to all types of recreation activities would take place if a large scale wildfire were to occur due to continued buildup of debris, brush and ladder fuels. Depending on the scale of the wildfire, it could cause some temporary or long term closures and inconvenience to the recreation user. In the worst case, fire damage to the forest could be extreme and take several decades to recover. In this scenario, many visitors would be displaced.

Alternatives 2 - 4

Direct Effects and Indirect Effects

Although there are some differences between the three action alternatives in the intensity of treatment and dropping of some group selection treatments, no real distinction between the alternatives can be made for the recreation resource. All action alternatives meet the recreation opportunity spectrum and visual quality objects of the 1992 Lassen Forest Plan, as amended; therefore, due to similarity, the effects analyses for each alternative are discussed together. Figure 30 and Figure 31 display the locations of the recreation facilities.

Dispersed recreation

Impacts to visitors camping, hunting, hiking, horseback riding, snowmobiling, driving for pleasure, sightseeing, OHV, or forest products gathering are expected to be minimal due to the size of the project area and the inclusion of two watersheds. It is unlikely that a visitor who has been temporarily displaced would be unable to find another suitable campsite within a short distance.

The Little Grizzly dispersed campground is located within a proposed RHCA treatment area and adjacent to a DFPZ treatment which may require a temporary closure of this dispersed camping site. Impacts to forest visitors would be minor as this site is used sporadically mid-week with a slight increase in use on week-ends and during the fall hunting season.

The area thin and RHCA treatments proposed adjacent to the Yellow Creek dispersed site would have a temporary impact to visitors. This site may be closed during operations if safety concerns arise. Other impacts would include some noise from operations equipment and increased traffic resulting in more dust. This site is used fairly consistently throughout the camping season by contractors working in the area and individuals who prefer a setting with no amenities or fees. Design features require that roads are kept open and free of debris and that the area is signed to alert the public of potential hazards.

Although there are treatments occurring within the RHCAs, impacts to fishermen are expected to be less than to general visitors because no mechanical treatments are proposed within the stream corridors. The largest impact to visitors would be due to the intermittent and temporary increase in large truck and heavy equipment traffic, operations noise and dust.

All of the project area could be temporarily impacted by smoke from prescribed burning operations, primarily in the fall. Impacts to air quality are discussed in the Fuels section. However, after Labor Day forest visitor use is minimal. Hunters may be temporarily displaced by this impact but many alternative locations are available to them nearby.

Developed recreation

Impacts to visitors at Soldier Meadows campground are expected to be minimal. There are no proposed treatments in or near the campground. Group selections are proposed on a ridge approximately 800 – 1,000 feet away. The largest impact to visitors would be the intermittent and temporary increase in large truck and heavy equipment traffic, operations noise and dust. All activities adjacent to developed facilities would be signed and controlled to alert the public of potential hazards.

Trails

One DFPZ treatment is proposed adjacent the Pacific Crest Trail that may require a temporary closure or reroute of the trail to allow through-hikers uninterrupted access during operations. Trail tread through this treatment area would be protected via contract clauses and any damage to the trail would be repaired. Design features require that trees within 150 feet of the Pacific Crest Trail are marked as cut trees so that remaining trees are not left with a paint band. Operations slash would be piled within 100 feet of the trail for post-operations burning. Additionally, trail tread would be protected and kept open and free of debris.

Portions of the Grizzly Creek Trail (currently not maintained) and the Peacock Point and Sunflower Flat trailheads are located in the vicinity of proposed area thin and DFPZ treatments. The Soda Creek Trail is outside of the project boundary and within a semi-primitive nonmotorized designation, so no activity would occur in this area. Operations activities in and around developed facilities (trails and trailheads) would be signed and controlled to alert the public of potential hazards. Roads would be kept open and free of debris during operations; however, slight delays may occur during roadside operations.

The Back Country Discovery Trail follows Plumas County Road 307.Slight disruption of normal travel may occur due to slow-moving equipment or loaded log trucks traveling at reduced speeds on steep grades.

The majority of the Jonesville snowmobile trail system occurs within the project area. However, no effect is expected since winter logging is not a typical practice on the Almanor Ranger District. In addition, a seasonal restriction between December 26th and April 1st would be placed on groomed snowmobile trails (Plumas County roads 307 and 309, and National Forest System roads 27N04, 27N65 and 26N27).

Access

Roads accessing the campgrounds, campsites, trailheads and trails would be kept open during operations. The haul routes, and areas of operation would be signed to notify the public of potential hazards. Roads within the project area may be subject to periodic safety related closures for project implementation (e.g. felling trees adjacent to roads or removing debris from travel way). Where possible, alternate routes would be identified and traffic redirected to avoid visitor inconvenience during operations. Safety provisions would be included in project contracts.

Design features would ensure that roads accessing campgrounds, trailheads, and trails would be kept open and free of debris.

The project proposal to decommission 0.99 miles of unauthorized OHV trails would not have a direct effect on the use and enjoyment of the developed or dispersed camping sites in the project area. Most of these routes are isolated segments that do not provide connectivity to an established motorized trail system recognized in the Forest motorized vehicle use map. The Motorized Travel Management ROD prohibits unauthorized cross country travel.

Visual Quality Objectives

Partial Retention and Modification

Given that the DFPZ and area thinning treatments occur along Plumas County Roads 307 and 308, management activities would remain visually subordinate to the surrounding landscape. With the existing variations of canopy closure along these roads, meeting the basic parameters for this visual quality objective would be likely. Some stumps may be visible in the foreground; however, as vegetation is reestablished the visual evidence would diminish.

Vegetative patterns of the thinned stands within the DFPZs and the area thinning include a mosaic of differing forest types, grassy meadows, and moderately uneven terrain. Some areas have a continuous canopy with some patterns of openings. Small openings would be created which would repeat the existing forms, colors and texture of the openings. Uncut areas, giving the more natural landscape appearance, would break up cutting along the roadside frontage. Establishing vegetation after treatment by natural regeneration, understory growth and reforestation would reduce exposed soil.

Group selection treatments may be visible a distance from the Pacific Crest Trail; however, they would be on the slope below observer eye level. In this case, most cutting units would have vegetative screens in the foreground from trail users' perspective. The units would appear as natural openings; in some instances they would be clustered together. The irregular edges used to define the groups would blend with natural openings and landforms in the middle and foreground as noted above. In addition, after slash disposal the groups would be planted for regeneration.

DFPZ treatments adjacent to the Pacific Crest Trail would have the most visual impact initially due to ground disturbance and debris. This treatment would result in fairly open stands dominated by larger trees. Design features, including cutting stumps to 8 inches, piling operation slash within 100 feet of the trail and using a cut tree mark within 150 feet of the trail would mitigate visual impacts post-treatment. The resulting openness would affect the recreation resource by allowing the areas to be more available physically to recreation visitors as well as open the scenery to viewing. In the long term, the open forest vistas with natural regeneration would offer forest visitors a somewhat park-like setting.

Cumulative Effects

The cumulative effects analysis boundary goes outside the project area and follows the Pacific Crest Trail. Although the Creeks II project only intersects the Pacific Crest Trail in one location, some view points along other portions of the trail (i.e. the west and north sides of the project area) are visible. The results of a viewshed analysis indicate that some of the landscape is within view of the Pacific Crest Trail. However, the model only accounts for terrain features and not for features on the landscape that may block visibility, including trees, rocks, down logs, canopy cover, etc. As such, the model distorts the actual sight distance from the trail. Several areas were field-checked to determine the validity of the model. At most points along the trail it was noted that sight distance was actually about 250 feet from the trail, obscuring any vista points from which the activities proposed under both action alternatives would be visible. Because some of the Creeks II project can be seen from the trail, it was necessary to bring the cumulative effects boundary to the Pacific Crest Trail.

The Creeks II project area has a long history of vegetation management projects. Impacts to visitors have been well mitigated and complaints are rare. The public appears to be satisfied with their recreational experiences as they enjoy the project area. No public complaints or suggested changes in management have been made to date. Occasional requests for special use permits for recreation events or group outings are received and are acted upon if they are feasible and in compliance with the 1992 Lassen Forest Plan as amended. Once the treatments have been completed, the recreating public would be able to enjoy their uses as before. Because of this, there would be little or no cumulative effect to recreation activities.

In the long-term, the project would improve the overall health of the forest and safety from wildfire thereby improving recreation opportunities in the future. People familiar with the area, especially those who return each year such as hunters and anglers, would be most aware of any limitations to recreation activities during project implementation. New or occasional visitors would be less aware of changes. Design features would reduce the short-term effects to recreation.

The project proposal to decommission 0.99 miles of unauthorized OHV trails would eliminate cross country travel, reduce erosion, and encourage visitors to the area to travel on authorized routes as identified in the motorized vehicle use map. Initially individuals who have historically used these OHV trails would be dissatisfied by the loss of this opportunity. With continuing education and enforcement of the Travel Management decision, individuals would be directed to routes designated for OHV use.

Additional Considerations

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.”

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).

Proposed treatments in DFPZ and area thinning would reduce competition for resources, which would improve overall stand growth and vigor and reduce individual tree mortality; stand densities would decrease as a result of treatments. Thinning would target the removal of damaged and diseased trees and favor retention of trees free of damage and defect. These treatments would increase the species composition of fire resistant trees such as sugar, ponderosa, and Jeffrey pine. Proposed treatments would retain or promote a higher component of pine within mixed conifer and white fir stands. Lower stand densities in the thinned stands would also promote the health of pine, since pine does not grow at the higher stocking densities that white and red fir can persist at. Open stands dominated be larger trees with relatively few scattered understory trees and regeneration are conditions that support low to moderate intensity ground fires. Treated stands would be more resistant to insect attack due to decreased stocking. Group selections would promote the regeneration of pine species and provide stand structure diversity. Forest composition and structure would move closer to desired conditions.

Treatments in DFPZ and area thinnings would reduce hazardous wildland fire behavior from fires both originating within treatments and from outside point sources (Graham et al. 1999). Treatment of surface, ladder, and canopy fuels would further help protect communities and resources in and around the DFPZs and area thinnings, while increasing safety for firefighters.

Reduction of surface fuels moderates surface fire behavior, allowing for direct attack by hand crews and fire engines. Thinning treatments would reduce wildfire from passive crowning to surface fires in many of the stands. After treatment, reduction in rate of spread means that the fire in the treated areas would be smaller when crews arrive and would be moving slower.

Overall, alternatives 2 and 3 would provide a long-term benefit to California spotted owl, northern goshawk and American marten habitat, with low potential risk to individuals Alternative 4 provides less short-term risk due to the reduction in treatment acres and the limited effect to the overstory canopy (most of the canopy loss would be in the understory) however there would be less long-term gain with regard to habitat improvement such as larger trees or as great a reduction in the risk of mortality due to insects or disease.

Alternative 4 would have the greatest impact in terms of reducing habitat value. Although smaller trees are being removed, the strict adherence to the thin from below treatment needed to meet fuels objectives would result in a reduction of near ground cover and a reduction in heterogeneity that is a desired outcome for alternatives 2 and 3. Treatments 1 – 4 would also generally reduce canopies to between 30 percent - 50 percent, lower than the treatments used in the other action alternatives (See chapter 3, Table 73). Treatments 4 and 5 would have little impact due to the limited impact to suitable habitat and retention of 40 percent canopy.

The project would be implemented with integrated design features designed to avoid or reduce the potential negative effects of the proposed activities on all resources including watershed, soils vegetation, wildlife, botany, heritage resources, recreation and range resources (integrated design features, appendix A).

Soil and water quality guidelines would be met (see chapter 3 for effects to soils and water resources).Based on a combination of field surveys and estimates of cumulative disturbance using equivalent roaded acres, soil quality guidelines for soil hydrologic function would be met in all project subwatersheds, as would soil productivity standards. Based on the results of the cumulative watershed effects analysis, implementation of BMPs and integrated design features (including RHCA designations and prescriptions), the risk of adverse cumulative effects to aquatic resources within the project area is low and beneficial uses of would be maintained. The analysis concluded that there is no loss of aquatic/riparian habitat and therefore there is no cumulative contribution to the loss of suitable habitat for aquatic and riparian dependent species within the HFQLG Pilot Project Area.

The implementation of any of the action alternatives provides public benefits such as local jobs, income generated from the forest products industry, and energy from local cogeneration plants.

Unavoidable Adverse Effects

Short duration production of smoke and associated emissions would occur during pile and understory burning. Several communities lie within proximity of the areas where both pile and prescribed burning is proposed to occur. Adherence to the smoke management plan for pile and understory burning would alleviate negative impacts to communities. By adhering to a smoke management plan approved by the Lassen National Forest Supervisor and the Northern Sierra Air Quality Management District, particulate matter emissions from pile or understory burning would not violate California Ambient Air Quality emission standards. Short duration production of smoke and associated emissions would occur during pile and understory burning. Treatment of fuels under all action alternatives would result in decreased smoke production and associated emissions in the event of a wild fire.

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.

All resources were evaluated to determine if there would be irreversible or irretrievable commitment of resources. No irreversible or irretrievable commitments of resources were found in any action alternative (2-4).

Other Disclosures

Possible conflicts between the proposed action and Federal, regional, State, and local land use plans, policies, and controls for the area concerned.

This project has been scoped with federal, tribal, regional, State and local government and any comments or concerns have been considered in developing the proposed action and alternatives. There are no known conflicts with land use plans, policies and controls in the project area.

Energy requirements and conservation potential of the various alternatives and mitigation measures.

The energy consumption from this project is not expected to vary by action alternative. Design features in appendix A of this EIS encourage the most efficient use of resources possible.

Natural or depletable resource requirements and conservation potential of alternatives and mitigation measures.

There are no natural resources anticipated to be depleted from any of the proposed actions.

Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of alternatives and mitigation measures.

This project would not include activities in urban areas would not affect urban quality or the design of the built environment. See heritage resources section in chapter 3 for effects to historical and cultural resources. Effects would be avoided through following Lassen Forest Plan direction and project design features listed in appendix A.

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Chapter 4. Consultation and Coordination

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Federal, State, and Local Agencies

The following federal, state and local agencies were consulted or collaborated in developing the proposed action or alternatives for the Creeks II project.

Almanor Basin Water Advisory Council
Butte County Fire Safe Council
Butte County Board of Supervisors
Butte County Public Works
California Department of Fish and Game
California Department of Forestry and Fire Protection
California Regional Water Quality Control Board, Central Valley Region
Environmental Protection Agency, Region IX
Lassen Volcanic National Park
Oregon State University
Plumas County Board of Supervisors
Plumas County Dept of Public Works
USDA Forest Service Pacific Southwest Research Station
USDA Forest Service Redwood Sciences Lab

Tribes

The following organizations representing affected tribes were consulted in 2008:

Susanville Indian Rancheria
Greenville Rancheria
Mechoopda Indian Tribe of Chico Rancheria,
Redding Rancheria
Pit River Tribe

Others

The following organizations and individuals were involved in the initial public scoping efforts in 2008 or collaboration efforts 2008-09.

Organizations:

Herger-Feinstein Quincy Library Group
Lassen Forest Preservation Group
Sierra Forest Legacy
John Muir Project
Yahi Group Sierra Club
Sierra Pacific Industries
Recreation Outdoor Coalition
Californians for Alternatives to Toxics
Environmental Science Associates
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Appendix A - Design Features

Integrated Design Features Common to Alternatives 2-4

Integrated Design Features (integrated design features) are elements of the project design that are applied as necessary in treatment areas. These features were developed to reduce or avoid adverse environmental effects of the action alternatives to forest resources.

Watershed

Lands adjacent to streams, meadows, and other wetlands on the forest are referred to as Riparian Habitat Conservation Areas (RHCAs, appendix L, HFQLG FEIS). RHCAs are managed differently than the rest of the landscape. In these areas, treatments are designed to ensure that riparian management objectives are met. In addition to the following integrated design features (integrated design features), all applicable best management practices (BMPs) would be implemented. BMPs are described in: Water Quality Management for Forest System Lands in California, Best Management Practices (USDA Forest Service 2000a), and SNFPA Record of Decision, 2004. Soil standards and guidelines established according to the Region 5, Sierra Nevada Forest Plan, and Lassen National Forest frameworks would be implemented throughout the project area.

The Lassen National Forest Scientific Analysis Team (SAT) guidelines would be implemented (Tables 2.6 thru 2.10 of the HFQLG ROD, 1999) for the protection of aquatic habitats or RHCAs. The integrated design features described below pertain to all stream channels, meadows, and aspen stands within the Creeks II project area. Integrated design features specific to fens and sensitive botanical habitats are addressed in the botany integrated design feature section below.

RHCA Widths

RHCAs are divided into an inner zone adjacent to the riparian feature and an outer zone with fewer restrictions adjacent to the inner zone.

Type of RHCA	Inner zone width	Outer zone width	Total width
Wetland / meadow less than one acre in size	50ft	50ft	100ft
Wetland / meadow greater than one acre in size	75ft	75ft	150ft
Perennial stream	150ft	150ft	300ft
Seasonally flowing stream	50ft	50ft	100ft
Fen			150 ft

Treatment in the inner zones:

1. Generally mechanical treatment in inner zones is prohibited unless mechanical treatment is deemed necessary to meet riparian management objectives and can be accomplished while minimizing risk of detrimental effects to the RHCAs. Below are design features if mechanical equipment is used:

    a. No mechanical equipment will be allowed within 25ft of stream channels.

   b. In meadows or aspen stands lacking stream channels, equipment may be allowed up to the edge as long as soil standards are being met.

   c. No mechanical treatment will occur if the slopes are over 20 percent.

2. Thinning by hand and removal by one end suspension is allowed as long as objectives for groundcover are met (see soil integrated design features).

3. Skid trails are to be left with 90 percent ground cover after operations.

4. Forest floor cover in the inner zone of RHCAs will be maintained at a minimum of 90 percent of pre-treatment levels.

5. In areas where a scoured continuous stream channel exists in the unit, no trees over eight inches d.b.h. will be removed within ten feet of the edge of the channel.

Treatment in inner and outer zones:

6. No mechanical treatment in RHCAs will take place on slopes greater than 35 percent in the outer zones.

7. Where fuel concentrations are high, hand piling or grapple piling of slash is allowed. All piles will be located a minimum of 25 feet from the edge of stream channels. If piles cover more than 10 percent of the area of the RHCA only 1/3 of the piles would be burned in any given year to avoid impacting the nearby stream environment. No piling would occur within aspen units, and any pile burning must be at least 25’ from aspen unit.

8. Broadcast burning would be allowed within RHCAs, but there would be no ignitions in the inner zone (fire may back through this zone).

9. There will be no construction of new landings or use of old landings without concurrence of a hydrologist, soil scientist, or fisheries biologist.

10. Conifers would be harvested with low-ground pressure rated feller-bunchers that have 24-inch or greater track widths.

11. No group selection cuts would occur in the RHCAs, although aspen treatments require the removal of most of the conifers below 30 inch d.b.h.

12. Riparian species (alder, willow, aspen, etc.) will not be removed.

13. Turning of tracked feller-bunchers would be kept to a minimum.

14. No cut and fill would be allowed for new skid trails in RHCAs.

15. Piling of fuels with dozers is prohibited in RHCAs. Skid trail crossings of RHCAs may be allowed with the concurrence of agency hydrologist, soil scientist, or fisheries biologist

16. Minor modifications of integrated design features may be allowed with the concurrence of agency hydrologist, soil scientist, or fisheries biologist

Soils

17. Lassen National Forest Wet Weather Operations and Wet Weather Haul Agreement will be followed during logging operations.

18. In RHCAs, Mineral soil shall be "dry" in the surface soil, as determined by the responsible official utilizing the Soil Moisture Operability Field-Guide; "dryness" is generally determined in the 4-8 inch depth zone; for soils with a texture change in the top 12 inches, "dryness" will be determined in the finer-textured zone. Soil moisture shall be evaluated after any/each precipitation event to determine if operations should continue or a drying-period shutdown shall occur. Exceptions to Field-Guide determinations may be permissible, as determined by a site-specific evaluation and agreement between the sale administrator and a Forest Service soil scientist or hydrologist.

19. Outside of RHCAs, mechanical equipment will be kept off of slopes greater than 35 percent, with the exception of short pitches (to be determined during preparation phase with consultation of soils specialist and sale admin if pitches exceed 150 feet).

20. The areal extent of project-related detrimental soil disturbance (excessive compaction and erosion) will not exceed 15 percent of the area dedicated to growing vegetation. Soil porosity will not decrease by 10 percent or greater and soil bulk density would not increase by 10 percent or greater when compared to pretreatment conditions.

21. Soil organic matter in the top 12 inches of soil, including humus and mineral soil organic matter, will be maintained at a minimum of 85 percent of pre-treatment levels in order to limit the negative effects of soil displacement on nutrient and water availability to plants.

22. Forest floor cover will be maintained at a minimum of 60 percent of pre-treatment levels. Insuring appropriate forest floor cover after treatment may require spreading slash over the mineral soil.

23. Outside the RHCA inner zones, skid trails and landings will be maintained at a minimum of 60 percent cover to reduce the chance of soil movement off the trails. Where possible, existing debris or logging debris will be left on the skid trails.

24. All temporary roads utilized during operations will be subsoiled. Landings and skid trails will be evaluated post-project by a soil scientist to see if subsoiling and/or an alternative compaction-remediation treatment is required. Subsoiling would lift and fracture the soil in place leaving it loose and friable to a minimum depth of 18 inches. Treatment should be repeated if furrows are left deeper than 12 inches. Subsoiling treatments may be discontinued with the concurrence of hydrologist, soil scientist, or fish biologist if an inspection reveals the subsurface rock size and distribution is such that effective operation is precluded.

25. Where temporary road and landing construction involves cut and fill, the feature will be subsoiled, then re-contoured to match the existing topography and slash scattered to provide ground cover. Slash will consist of organic material (logs, branches, and duff). Rocks and boulders would also be utilized. Slash will be scattered to resemble a natural appearance similar to the surrounding landscape. These areas would be sufficiently blocked at the entrances to preclude access by motorized wheeled vehicles. Where temporary roads cross stream channels, all fill will be removed from the channel and utilized for re-contouring or spread in a stable location outside the RHCA.

26. To the extent possible, existing landings and skid trails will be utilized thus minimizing any new disturbance within the project area.

27. The landings associated with aspen treatments will be pre-designated by the Forest Service.

28. Down coarse woody material will be retained at an average of at least 10-20 tons per acre over a treatment unit with the largest logs preferentially retained. Logs smaller than 12 inches d.b.h. will not

be included to meet this standard. Decay classes 1, 2 and 3 will be preferentially used where available.

29. Contract provision C6.6# (Erosion Prevention and Control) would be included in the timber sale and/or service contracts.

Silviculture

30. Cut stumps of live conifers 14 inch diameter or greater would be treated with an EPA registered borate compound which is registered in California for the prevention of annosus root disease. No borate compound would be applied within aspen treatment units or within 25 feet of known sensitive and special interest plants or within 25 feet of standing water.

31. Aspen stands where they occur within DFPZ and area thinning treatments and not treated under treatment F would be protected. Ladder and canopy fuels would be thinned away from aspen. Aspen would be retained while minimizing impacts to the clones as much as practicable. Group selection harvest units would not be placed within aspen clones or landings.

32. For aspen stands treated under treatment F:

    a. Aspen trees with 3.0-inch d.b.h. or greater would be protected from damage during harvest activities. All aspen snags would be retained within the limits of operability.

    b. Temporary fencing would be constructed around treatment units as needed to prevent damage to young aspen sprouts from browsing animals.

    c. No piling or burning would be permitted within aspen stands and burn piles would be constructed a minimum of 25 feet from the most distal aspen.

    d. No landings would be permitted within the aspen stands.

    e. Small conifers (less than 12.0-inch d.b.h.) unable to be removed by mechanical means would be removed using a follow-up hand-thinning treatment where necessary to achieve treatment goals.

33. All sugar pine identified as rust resistant or as a candidate for rust resistance would be protected. A $20,000 fine would be imposed for each rust-resistant or candidate tree damaged during operations. Healthy sugar pine showing no observable signs of blister rust would be favorably retained.

34. A primary objective of all silviculture treatments is to increase species diversity and promote residual tree health and vigor and stand heterogeneity. To promote species diversity, healthy shade intolerant pine (ponderosa, sugar, and Jeffery) and Douglas-fir need to become a larger component of stands where they naturally occur. These species would be favorably retained over shade tolerant species in all treatments. Although shade tolerant trees, particularly white fir, would be targeted for removal, as a species they would be maintained within the thinning treatments.

Group Selection

Three of the primary objectives behind the use of group selection treatments in the Creeks II project are to begin the process of increasing the pine component in areas or sites that were historically dominated by pine; to add species and structural diversity to stands and sites that are lacking in diversity, usually older, thinned stands; and, to promote community stability by providing merchantable material to local mills. The following integrated design features are proposed to help achieve these objectives.

35. Control of competing vegetation would be needed on all proposed group selection acres to ensure the survival and growth of desired young conifer seedlings. Vegetation control would be performed by hand grubbing or scalping of competing plants. No herbicide treatments to competing vegetation are proposed within group selections or DFPZs. Plantation performance would be monitored after the 1st and 3rd years as required by the National Forest Management Act to ensure successful regeneration within 5 years after harvest (36 CFR 219.27).

36. Group selections would be located on slopes of 35 percent or less to reduce harvest site preparation and planting costs, and improve the feasibility of including group selection in the proposed treatments.

37. If necessary, group selections could be used for landings during harvest operations.

38. Site preparation for planting would consist of machine piling of pre-and post-harvest slash within each group selection.

39. If deemed necessary by the district silviculturist/culturist and soil scientist, sub-soiling could be required in group selection areas prior to planting.

40. Trees 30-inch d.b.h. or greater would be retained, within the limits of operability.

41. Some group selections could retain up to40-60 ft^2/acre of larger, overstory trees. This reserve basal area could include all trees over 30-inch d.b.h., as well as other disease-free, healthy pine.

42. The size of the group selections could vary within the Creeks II project area. Where group selection is used to restore pine, add diversity to older, thinned stands, or have a considerable component of larger, residual, overstory trees, group selections could be up to two acres in size to accommodate the needs of shade-intolerant pine.

43. Groups would be artificially planted with container or bare root seedlings within five years of harvest. The seedlings would be manually planted with auger or hoe.

44. A mixture of pine species would be emphasized in group selections that are intended to achieve pine restoration.

45. Manual release could be required within two to five years after planting to improve survival of the planted conifers. Manual release for this purpose could include manual grubbing or mechanical release (mastication). No planned use of herbicides would be included within groups as part of conifer release for survival.

46. If determined necessary by the silviculturist/culturist, vexar tubes could be placed over planted seedlings to prevent animal browsing, and gophers could be controlled by trapping.

Fuels

47. Within all treatment areas except where precluded by other integrated design features (RHCAs), surface and small ladder fuels would be mechanically treated where possible. Whole tree yarding (removing the intact tree) would be implemented wherever feasible to reduce surface fuel accumulation.

48. Surface fuels of down, woody material greater than 12-inches diameter at end point would be retained at 10-15 tons per acre where it exists. Smaller surface fuels (material that is 3 inches in diameter or less) would be retained at no more than 5 tons per acre.

49. Within RHCA inner zones, piling would be required.

Wildlife

50. The following Limited Operation Periods (LOP) would be implemented within ¼ mile of known active nest sites:

    a. California spotted owl, March 1 - August 15

    b. Northern goshawk, February 15 - September 15

51. If a California spotted owl nest is discovered, a 300-acre protected activity center (PAC) will be developed surrounding the nest site commensurate with current direction.

52. If new, active goshawk nest sites are found within the project area:

    a. A 200-acre protected activity center would be developed.

    b. The nest tree would be protected with a 125-foot no treatment buffer if found inside a unit during operations.

    c. The marking treatment would be adjusted within the newly defined territory to meet habitat goals to attain suitable nesting habitat within two decades by maintaining a minimum of 40 percent to 50 percent canopy cover and heterogeneity.

53. In unsurveyed California spotted owl or northern goshawk suitable habitat, LOPs would be implemented until surveys have been completed.

54. Implement a Limited Operating Period within buffers surrounding occupied marten or fisher den sites.

    a. Marten - May 1 through July 31

    b. Fisher – March 1 through June 30

55. Where small (non commercial) conifers are present as an understory, retain trees with 50 percent live crown and a d.b.h. of 10 inches or less unless doing so does not meet fuels objectives.

56. Within mastication units, retain 10 - 15 percent of the existing shrub cover. Retain higher percentage of existing shrubs within units that have lower amounts of shrub cover overall.

Snag Retention Guidelines

Snag retention guidelines would be developed for this project that attempt to sustain across the landscape a generally continuous supply of snags and live decadent trees suitable for cavity nesting wildlife. Where existing, the following snag retention guidelines would be implemented within the project area:

57. Maintain 0-1 snags per acre within 150 feet of any road that do not meet criteria for hazard trees, within DFPZ treatment units.

58. Maintain 2-4 snags per acre within the remainder of DFPZ treatment units.

59. Within area thinning units, retain 4 snags per acre in mixed conifer stands and 6 snags per acre within red fir stands where they exist. The goal would be to retain the largest snags available. Snags larger than or equal to 15-inch d.b.h. would be used to meet these guidelines.

60. Snags would be clumped and distributed unevenly. The treatment area would be considered as a whole when figuring snag retention levels with consideration also given to site conditions. Sites with low productive potential would generally have fewer snags than highly productive sites.

61. Snag selection would emphasize retaining fading or recently dead trees as these provide desired excavating and foraging substrates.

Down woody retention guidelines would be developed for this project that would generally retain an average across treatment units of 10-15 tons of large down wood per acre. This material would consist of logs greater than 12-inch size at the small end and a minimum of 6 feet in length.

Botany

TES and Special Interest Plants

62. All occurrences of *Botrychium ascendens* (upswept moonwort), *Botrychium crenulatum* (scalloped moonwort), *Botrychium minganense* (Mingan moonwort), *Botrychium montanum* (western goblin), *Botrychium pinnatum* (mountain moonwort and *Botrychium simplex* (Yosemite moonwort) would be protected from all project activities, except underburning, through flag and avoid methods and their locations displayed as control areas on all on contract maps.

63. All occurrences of *Meesia triquetra* (three-ranked hump-moss), *Meesia uliginosa* (broad-nerved hump-moss), *Eriophorum gracile* (slender cottongrass), and *Drosera anglica* (English sundew) and their associated meadows and/or fens would be protected from project activities through flag and avoid methods. All fens and associated meadow locations would be displayed on contract maps.

64. New occurrences of threatened, endangered or sensitive (TES) plant species discovered before or during ground-disturbing activities would be protected through flag and avoid methods.

Wet Meadows (Fens)

65. The RHCA would extend 150 feet from the edge of all fens and those wet meadows with occurrences of *Meesia triquetra* and/or *Meesia uliginosa*.

66. Live vegetation and snags would be retained within the RHCA zones around fens.

67. Hand and/or machine grapple piles would be placed outside of the RHCAs around fens.

68. Broadcast burning would be allowed within the RHCA's of known wet meadows (fens), but there would be no ignitions within the RHCA around there areas (fire may back through this zone).

Noxious Weeds

69. All off-road equipment would be weed free prior to entering the Forest.

70. Known noxious weed infestations would be identified, flagged where possible, and mapped for this project. Identified noxious weed sites within or adjacent to the project area containing isolated patches with small plant numbers would be treated (hand pulled or dug) prior to project implementation. Any larger or unpullable infestations would be avoided by harvesting equipment to prevent spreading weeds within the project.

71. All Canada thistle occurrences within treatment units will be flagged and avoided by mechanical equipment, however, hand thinning will be allowed within these areas. Hand piles and grapple piles

would be placed outside of known occurrences. All occurrences will be displayed as control area on contract maps.

72. No ripping would occur within or adjacent to the known Canada thistle occurrences along Rd 27N14B during road decommissioning activities at the headwaters of Butt Creek.

73. Underburning would not be allowed within known Canada thistle occurrences.

74. New small infestations identified during project implementation would be evaluated and treated according to the species present and project constraints. If larger infestations were identified after implementation, they would be isolated and avoided with equipment.

75. Post project monitoring for implementation and effectiveness of weed treatments and control of new infestations would be conducted as soon as possible, and for multiple-years after completion of the project.

76. If project implementation calls for mulches or fill, they would be certified weed free.

Heritage Resources

77. All historic properties and potentially eligible properties (unevaluated sites) within areas of DFPZ construction, area thinning, and group selection harvest or other project related activities (i.e., construction or use of log landing or waterholes) would be protected by flagging site boundaries as non-entry zones for project activities (flag and avoid). No activities would occur within site boundaries. Project activities would be kept twenty meters from established site boundaries at all times.

78. Linear sites such as historic roads, ditches, and prehistoric quarries, etc., could be crossed on a limited basis in previously disturbed areas. All crossings would be made perpendicular to the site and the site would be returned to its original design at project completion. All crossings would be designated by the District Archeologist.

79. Hauling on main National Forest System roads that bisect heritage sites would continue. Maintenance, decommissioning or obliteration of these roads would not take place within site boundaries. Vehicles and/or equipment using these roads would remain on the road prism while traversing a heritage site. Exiting the road prism while within site boundaries would not occur. The construction of new permanent or temporary roads would not cross heritage sites.

80. Hauling on existing National Forest System spur roads or unauthorized roads that bisect heritage sites would only be allowed under one of the following conditions: 1) the section of roadway bisecting site would be padded to protect the archaeological deposit; 2) the road would be realigned around the existing site; or, 3) the site would be evaluated for National Register eligibility and found ineligible for listing. Maintenance, reconstruction, decommissioning or obliteration of spur roads or unauthorized roads would not take place within site boundaries unless the site was determined ineligible for the National Register of Historic Places.

81. Archaeological sites within treatment areas, activity areas, or on roads would be monitored during and after project completion.

82. If unanticipated heritage resources are encountered during project activities, all work would immediately stop in the vicinity of the find until an assessment of the situation is made by heritage resource specialists.

Special Uses / Recreation

83. No project activities would occur within posted campground boundaries and all facilities would be protected.

84. Cut tree marking would be applied within 200 feet of developed campground boundaries.

85. Operations-created slash within 200 feet of developed campground boundaries would be piled for burning.

86. All activities adjacent to developed facilities would be signed and controlled to alert the public of potential hazards.

87. Roads accessing campgrounds, trailheads, and trails would be kept open and free of debris.

88. Seasonal restrictions are in place for winter recreation (cross country ski, snowmobile) from December 26 through April 1 annually. Tehama County roads 307 and 309, and National Forest System roads 27N04, 27N65 and 26N27).

89. The trail tread would be protected on all system trails. Operations-created slash within 100 feet of system trails would be piled for burning.

90. Cut tree marking would be applied within 150 feet of the Pacific Crest National Scenic Trail (PCT). Operations-created slash within 100 feet of the PCT would be piled for burning.

91. Site preparation for planting would consist of machine piling of pre-and post-harvest slash within each group selection.

92. No project activities would occur within posted campground boundaries and all facilities would be protected.

93. Cut tree marking would be applied within 200 feet of developed campground boundaries.

94. Operations-created slash within 200 feet of developed campground boundaries would be cleaned up 100 percent.

95. All activities adjacent to developed facilities would be signed and controlled to alert the public of potential hazards.

96. Roads accessing campgrounds, trailheads, and trails would be kept open and free of debris.

97. A LOP from December 26th through April 1st would be placed on groomed snowmobile trails (Tehama County roads 307 and 309, and National Forest System roads 27N04, 27N65 and 26N27).

98. Cut tree marking would be applied within 150 feet of the Soda Creek Trail. The trail tread would be protected. Operations-created slash within 100 feet of the Soda Creek Trail would be cleaned up 100 percent.

99. Cut tree marking would be applied within 150 feet of the Pacific Crest National Scenic Trail (PCT). Operations-created slash within 100 feet of the PCT would be cleaned up 100 percent.

Range

100. The timber sales administrator would coordinate treatment operations with the District Rangeland Specialist so that timely consultation can be conducted with the grazing allotment permit holders.

101. Existing fences, corrals and range improvements (salt tubs, water troughs, etc.) would be avoided and/or protected from project operations. The Forest Service would ensure damage to range improvements caused by project implementation is repaired.

102. If needed, the distribution of livestock will be controlled the season following project implementation by various protection methods in order to protect treatment areas.

103. Fences, water developments, cattleguards, existing study areas and transects would be protected. Repair of damage to range improvements due to project activities would be the responsibility of the contractor.

104. Consultation with the District Rangeland Specialist and allotment permittees would be conducted to coordinate treatment operations. If treatment occurs in areas that need protection, mitigation measures would be developed such as fencing or controlling distribution with other measures (i.e. placing supplements away from treated areas, moving livestock to another area, etc.)

105. The aspen would be examined prior to release then monitored for 5-years after release, inside and outside of the proposed fence line. See Modified Proposed Action for greater detail.

Safety

106. During project implementation, the public would be alerted to potential hazards through signing along National Forest System roads. National Forest System road 27N65 could be subject to periodic closures for project implementation and temporary closures of all roads could occur for safety reasons. Safety provisions would be included in project contracts.

Appendix B - Maps

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Map 1- Vicinity Map

Map 2- Proposed Action- Alternative 2 Harvest Treatments and Road Actions

Map 3- Alternative 3 Treatments Harvest Treatments and Road Actions

Map 4- Alternative 4 Treatments Harvest Treatments and Road Actions

Map 5- Alternative 2 Post Harvest Fuels Treatments

Map 6- Alternative 3 Post Harvest Fuels Treatments

Map 7- Alternative 4 Post Harvest Fuels Treatments

Map 8- Proposed Road Actions for Alternatives 2 and 3

Map 9- Proposed Road Actions for Alternative 4

Appendix C – Treatment Descriptions

DFPZ Treatment Descriptions

The DFPZ treatments are labeled as A, B, C, M and O under alternatives 2 and 3 and labeled 1-3 under alternative 4.

Treatment A - DFPZ surface, ladder and canopy fuels

Trees would be thinned using a modified "thin from below" technique which emphasizes removing the smaller trees and leaving the larger, healthier trees. To enhance stand heterogeneity, "thin from below" would be modified to focus the removal of trees from a variety of size classes in proportion with their occurrence in the stand. This treatment would leave a complex stand structure with a reduced potential for fire to carry through the treatment area. Small understory conifer trees would be thinned where they could serve as ladder fuels to adjacent overstory trees. Mid- and upper-story trees would be removed to protect adjacent "leave" trees and to break up canopy fuel continuity. The remaining canopy cover would generally average between 30 percent - 40 percent.

Relatively open stands that are considered unsuitable habitat for the California spotted owl and American marten would be included in this treatment. In these stands treatments would focus on removing undesirable surface and ladder fuels and occasional mid- and overstory trees in dense pockets while retaining variable spacing of overstory and understory trees as described above.

Plantations would also be included in this treatment. They would be thinned to approximately 125-200 trees per acre, depending on species and tree size, to reduce fuel continuity.

Objectives addressed by treatment A:

- Objective 1: Improve tree vigor, growth, and insect and disease resistance by reducing stand densities and by favoring the retention and development of pine species.
- Objective 2. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

Treatment B - DFPZ Surface, ladder and canopy fuels in CWHR 5M, 5D, and 6 size stands

This treatment applies to stands categorized as CWHR 5M, 5D and 6. These are stands that have a quadratic mean diameter of 24-inches or greater now and an average canopy cover of 40 percent or greater (CWHR 5M) or 60 percent or greater (CWHR 5D and 6). This treatment would retain stand structures at the upper end of the desired range for a DFPZ. Canopy cover would be retained at approximately 40 percent - 50 percent. Emphasis would be placed on breaking up ladder and surface fuel continuity while maintaining canopy cover and stand heterogeneity.

Emphasis would be placed on thinning small understory trees where they could serve as ladder fuels to adjacent overstory trees. Mid- and upper-story trees would be removed to protect adjacent "leave" trees by breaking up ladder and canopy fuel continuity and to reduce competition for limited resources during times of stress such as drought conditions.

Objectives addressed by treatment B:

- Objective 4. Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.
- Objective 2. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

- Objective 1. Improve tree vigor, growth, and insect and disease resistance by reducing stand densities and by favoring the retention and development of pine species.

Treatment C - DFPZs modified to provide habitat connectivity

Treatment C would be applied to areas where maintaining late-seral habitat connectivity in known marten locations is paramount. These areas are located in the red fir belt on the west side of the project area near Humbug Summit and east of Ruffa Ranch, north of Butt Creek.

Small understory trees would be removed where they could serve as ladder fuels to adjacent overstory trees. Mid- and upper-story trees would be removed to protect adjacent "leave" trees by breaking up ladder and canopy fuel continuity and to reduce competition for limited resources during drought conditions. Treatment C would retain a minimum of 40 percent canopy cover where it exists. Where the initial canopy cover is less than 40 percent, the canopy cover would be reduced by no more than 5 percent. This treatment would stress not only canopy retention, but also the development of a number of attributes such as large trees, multi-layered stands, and vegetative diversity in both species and structure.

To provide structural heterogeneity within the stand, untreated "diversity islands" of approximately 1/8 acre to 2 acres in size would be left throughout the treatment units. These islands would provide a component of dense clumps of trees over approximately 25 percent of the treatment unit and would be representative of pre-treatment stand conditions. Approximately one-half the islands would receive hand treatment to reduce surface and small ladder fuels. Diversity islands would be scattered throughout treatment units, but would be placed a minimum of 100 feet away from roads to provide firefighter safety.

Objectives addressed by treatment C:

- Objective 4. Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.
- Objective 1. Improve tree vigor, growth, and insect and disease resistance by reducing stand densities and by favoring the retention and development of pine species.
- Objective 2. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

Treatment O - Owl foraging habitat (CWHR 4M, 4D) in areas adjacent to California spotted owl activity centers

This treatment would be used in stands composed of foraging habitat that are adjacent to California spotted owl activity centers. This treatment would also be assigned to some stands that are not suitable habitat (smaller trees and a more open character) but may have inclusions of suitable habitat or have attributes that could be developed as suitable habitat in the near future. A key element to this treatment would be the retention of diversity islands in approximately 15 percent of the treatment area. Treatment O would alternately thin and retain diversity islands to emphasize the retention of suitable habitat characteristics immediately after treatment and reduce the risk of widespread mortality from insect and disease outbreaks, as well as reducing impacts due to wildfire

Objectives addressed by treatment O:

- Objective 4. Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.
- Objective 1. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

Treatment M - DFPZ Surface, ladder and canopy fuels in CWHR 4M, 4D, and 5 size stands

Treatment M would be applied to stands within red fir that have a CWHR value of 4M, 4D, or 5. Treatment M would address fuels and meet DFPZ objectives, but focuses on long term improvement in marten habitat within the Creeks II project area. The treatment includes guidelines that emphasize (1) stand structure, heterogeneity, and diversity by leaving a range of tree size classes in the red fir type; and, (2) the retention and development of important habitat attributes such as down logs and cover for marten and its prey. Treatment M also would incorporate untreated areas, such as riparian areas and leave islands scattered through the treatment units, to retain habitat connectivity on the landscape.

A number of elements make up treatment M and are all essential to not only retain the habitat quality that exists, but to also ensure that habitat remains or even improves over time. The elements considered in the treatment include:

1. Canopy and stand density - A target of 180 - 200 ft^2 basal area in trees greater than 10 inches d.b.h. is desired where it can be obtained. In some cases, the basal area must be taken lower to attain other habitat goals or there simply may not be that level of basal area.

2. Snags - This is one of the most important components of marten habitat, providing future down logs and den sites that will provide safe cover from the harsh winter weather as well as places for the rearing of young. Six snags per acre of the largest and best snags will be kept.

3. Understory - With few exceptions, there is very little existing understory due to the excessive stand densities. Thinning will help promote the development of understory vegetation.

4. Develop hiding cover - The treatment will obviously reduce the overhead canopy. To provide future (and better) cover for marten and habitat for marten prey, small (one-quarter to one-half acre) group selections will be placed in selected areas adjacent to existing openings to develop dense cover by shrubs and/or young trees. These groups will be left to naturally regenerate and no site preparation activities would take place (approximately 10 acres)

5. Protection of important habitat elements - To protect habitat attributes such as logs that could serve as den sites, snag patches, or other unique habitats, these areas would be designated as leave islands and would have either light treatment (removal of ladder fuels) or no treatment.

6. Connectivity - The treatment incorporates the untreated riparian areas (Riparian Habitat Conservation Areas) as travel corridors as part of the overall strategy to provide marten habitat connectivity at the landscape level.

Objectives addressed by treatment M

- Objective 4-Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.
- Objective 5-Increase heterogeneity and diversity within size class 4 stands.
- Objective 2-Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

Treatment 1 - DFPZ surface, ladder and canopy fuels

All understory conifer trees would be thinned with an upper diameter limit of 14 inches where operability allows. A minimum of25 percent of trees at or below 14 inches in diameter would be retained.. Emphasis would be placed on breaking up ladder and surface fuel continuity. A minimum canopy cover of 30 percent would be retained where available.

Treatment 2 - DFPZ surface, ladder and canopy fuels

All understory conifer trees would be thinned with an upper diameter limit of 12 inches where operability allows. A minimum of 20 percent of trees at or below 12 inches in diameter would be retained. Emphasis would be placed on breaking up ladder and surface fuel continuity. A minimum canopy cover of 30 percent would be retained where available.

Treatment 3 - DFPZs surface, ladder and canopy fuels

All understory conifer trees would be thinned with an upper diameter limit of 16 inches where operability allows. A minimum of 10 percent of trees at or below 16 inches in diameter would be retained. Emphasis would be placed on breaking up ladder and surface fuel continuity. A minimum canopy cover of 30 percent would be retained where available.

Area Thinning Treatment Descriptions

The area thinning treatments are labeled as D and E under alternatives 2 and 3 and labeled as 4 and 5 under alternative 4.

Treatment D - Area Thinning in CWHR size classes 2 and 3 and CWHR 4S and 4P.

This treatment would apply to treatment units in CWHR size class 2 and 3, as well as sparse open stands classified as CWHR 4S and 4P. These treatment units may contain small aggregates of suitable habitat (CWHR 4M, 4D). The objectives of this treatment would be to reduce potential fire mortality by breaking up the continuity of fuels and to provide for the development of late-seral habitat.

Treatment would focus on removing the smaller midstory and understory trees that may serve as ladder fuels and removing occasional larger midstory and overstory trees (up to 30-inch d.b.h.) from dense pockets to provide crown separation and reduce fuels continuity. Average canopy cover would be retained at or above 40 percent in areas that meet suitable habitat criteria.

Radial release would be implemented around 3 to 5 large trees per acre, with a focus on retaining the largest pine in the treatment area. Radial release consists of removing all trees smaller than the selected tree (and less than 30-inch d.b.h.) for a distance from the bole in feet for a numeric conversion equal to the selected tree's diameter in inches and not to exceed 30 feet. For example, a radial release around a 26-inch d.b.h. pine would extend out for 26 feet. This treatment would provide more resources to the selected trees during times of increased stress, such as when water availability is critical. These are the trees that develop the critical habitat attributes preferred by late-seral species. When droughts or insect infestations occur, the larger trees, especially pine, tend to be susceptible to mortality, particularly when growing in dense stands. Radial release would promote the survival of the selected large trees during drought events and remove ladder and canopy fuels, providing a greater opportunity to maintain the presence of large pine on the landscape today and into the future.

Objectives addressed by treatment D:

- Objective 1. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.
- Objective 2. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

Treatment E - Area thin in suitable owl habitat (CWHR 4M, 4D, 5M, 5D, and 6)

This treatment would apply to stands in CWHR types 4M, 4D, 5M, 5D, and 6 where tree growth, if not currently limited, would be limited in the near future due to competition for resources. Left untreated, density-related mortality is projected to reduce the number of trees in these stands over the next 15 years (USDA 2007). By thinning these stands, higher levels of canopy cover are more likely to survive over time because of the reduced risk of extensive insect mortality and/or fire associated with overly dense stand conditions. Retaining relatively high levels of canopy cover immediately after thinning, varying the intensity of thinning, and retaining diversity islands would all be elements of this treatment designed to retain structural diversity; break up the continuity of fuels; and, provide growing space, water and soil nutrients for the residual trees to thrive.

To achieve these conditions, this treatment would retain an average canopy cover between 40 percent - 50 percent. Radial release would be implemented around 3 to 5 large trees per acre as described in treatment D. Diversity islands would be retained over 15 percent of the treatment area.

Objectives addressed by treatment E:

- Objective 1. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.
- Objective 4. Retain and promote habitat connectivity and stand heterogeneity for late-seral wildlife.
- Objective 2. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.

Treatment 4 - Area thinning

All understory conifer trees would be thinned with an upper diameter limit of 14 inches where operability allows. A minimum of 25 percent of trees at or below 14 inches in diameter would be retained. A minimum canopy cover of 30 percent would be retained where available.

Treatment 5 - Area thinning

This treatment would apply to stands within inner zones of riparian habitat conservation areas. All understory conifer trees would be thinned with an upper diameter limit of 12 where operability allows. 10 percent of trees at or below 14 inches in diameter would be retained. Canopy cover retained at no less than 40 percent. This treatment would apply to stands within inner zones of riparian habitat conservation areas. All understory conifer trees would be thinned with an upper diameter limit of 12 inches where operability allows. A minimum canopy cover of 30 percent would be retained where available.

Group Selection Treatment Descriptions

Treatment GS

Groups would be placed predominantly within CWHR size class 4 stands whose species composition has increasingly shifted toward white fir as a result of fire exclusion. Groups would also be placed in previously thinned (from approximately 10 to 30 years ago) stands that are predominantly white fir and lack structural diversity. The land base available and desirable for implementing group selection was determined based on land allocations, project objectives, habitat considerations, and logging feasibility. To meet the objective of maintaining spotted owl nesting habitat, groups would not be placed within CWHR size class 5 or 6 or stands that are distinctly multi-storied stands. To meet the objective of maintaining American marten habitat connectivity, groups would generally not be placed within stands in the red fir forest type. . Two exceptions could be heavily diseased CWHR 4M red fir stands that are currently dying out and younger CWHR 4 red fir stands that have high crown ratios and pointed tops and that lack late-seral structure. Group selections would be proposed in these stands to begin developing the next generation of live trees.

Groups would range in size from one-half acre to 2 acres. Groups within white-fir dominated, previously thinned stands would average closer to two acres in size. Approximately 7 percent of the available and suitable land base within the project area would be treated by group selection harvest under this proposal.

Using a projected 20-year re-entry period, this equates to a group selection harvest level of 0.35 percent of the available land base per year.

A combination of natural regeneration and tree planting would be used to achieve a desirable species mix and seedling density (stocking). Regeneration of shade-intolerant native pine species would be emphasized in all groups.

Objectives addressed by Group Selection:

- Increase heterogeneity and diversity within size class 4 stands.

Aspen Treatment Description

Treatment F

Designated conifers would be removed from the most distal aspen tree or sprout along the edge of the existing aspen clone on the south, east, and west sides of the stand out to 200 feet. On the north side of the stand, conifers would be removed within 150 feet of the most distal aspen tree or sprout. Additional conifers may be removed outside of the 200 ft buffer if they are within the designated treatment area boundary and are encroaching or overtopping other riparian hardwoods such as willows, alders, or cottonwoods.

All conifers between 3.0-inch and 29.9-inch d.b.h. would be removed, except those trees described as leave trees or transition trees below.

All conifers greater than 29.9-inch d.b.h. would be designated as leave trees regardless of species and tree characteristics.

To recruit a component of conifers that reflect the range of natural variation, additional conifers ranging from 24.0-inch to 29.9-inch d.b.h. would be left as "transition trees" when they are

- Located within the treatment area from the most distal aspen stem and extending out to the edge of the unit boundary (described above).
- Located within 50 feet of a stump, downed log, or snag that indicates previous occupancy of a conifer greater than 29.9-inch d.b.h.
- The largest live tree of the following species: sugar pine, western white pine, Jeffrey pine, ponderosa pine, Douglas-fir, red fir, or incense cedar.

Where trees meet the criteria listed above and such trees occur as a clump (within five feet of each other), the entire clump would be retained.

Objectives addressed for treatment F:

- Objective 6:Promote the health of aspen stands

RHCA Treatment Descriptions

Vegetation treatments within RCHAs (inner and outer zones) will follow the DFPZ or area thinning treatment (A, B, D, E, F, and O) designated for the adjacent stands (Table 4). Treatments within the inner zone of RHCAs would be implemented to ensure that riparian management objectives would be achieved, including the maintenance of sufficient stream channel cover, future large woody debris recruitment, vertical stand heterogeneity, and species diversity. Furthermore, canopy cover would range from 40 to 50 percent where possible post-implementation and no trees larger than 24 inches d.b.h. would be removed.

Specific design features, best management practices and soil standards have been developed for activities within RHCAs and to minimize adverse impacts to resources (see appendix A for a detailed description of integrated design features and other guidelines). For aspen treatments (treatment F) within RHCAs refer to Aspen section above, and integrated design features listed in appendix A.

Treatments proposed in the outer zone would provide for continuity of upslope fuel treatments in the outer zone of RHCAs to provide protection for the RHCAs and improve effectiveness of the treatments at larger scales. Treatments proposed in the inner zone would reduce high stand densities, high fuel loadings and improve species diversity.

Objectives addressed with RHCA treatments:

- Objective 7. Improve watershed condition.
- Objective 8. Improve vegetative conditions within Riparian Habitat Conservation Areas (RHCAs) to meet Riparian Management Objectives.

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Appendix D- Riparian Management Objectives

Scientific Analysis Team (SAT) guidelines would be implemented (appendix L of the 1999 HFQLG FEIS) for the protection of aquatic habitats, otherwise known as Riparian Habitat Conservation Areas (RHCAs). These guidelines include recommended buffer distances for aquatic features, including fens that depend on recruitment of wood to maintain their unique soil and vegetative characteristics. Swales are also afforded protection (avoided by mechanical equipment) to prevent increases in delivery of sediment and runoff. Treatments within RHCAs are designed to maintain and enhance riparian conditions, specifically reducing the effects of wildfire and improving both short and long-term function by increasing plant diversity and vigor. All timber management and fire/fuels management proposed within these RHCA buffers must meet the Riparian Management Objectives. This appendix includes a discussion of the effect of the proposed project on riparian management objectives:

1. Maintain or restore water quality to a degree that provides for stable and productive riparian and aquatic ecosystems. Water quality parameters that apply to these ecosystems include the timing and character of temperature, sediment and nutrients.

Based on observations of similar project implemented in nearby watersheds (e.g. Battle DFPZ, Warner DFPZ) on the Lassen National Forest, and results from monitoring BMP implementation and effectiveness on Lassen National Forest, that have shown on-site objectives of BMP to be met when BMP are implemented, water quality of streams within the project area would be maintained. Stream shading would be measurably reduced only in those stands adjacent to stream channels where fuels reduction and aspen enhancement treatments occur. Based on monitoring results on Lassen National Forest from SF Bailey Creek and Pine Creek, where similar aspen treatments were implemented and both shade and water temperature were measured, shade is expected to be reduced slightly in the short term, but no measurable increased in stream water temperatures are expected. Soil moisture in treated stands would be increased, but no measurable change in base flows are expected, so no reduction in temperature is expected. Likewise, because in-channel baseflow and peakflows are not expected to be measurably affected, no change in nutrients or other chemical constituents of water quality are expected. Such changes might result if the amount and or timing of groundwater delivery to channels were affected. Changes in delivery of nutrients (especially phosphates) might also result if delivery of sediment were affected. No adverse change in sediment is expected, as discussed in the next section.

2. Maintain or restore the stream channel integrity, channel processes, and sediment regime under which the riparian and aquatic ecosystems developed. Elements of the sediment regime include the timing, volume and character of sediment input and transport.

Treatments within RHCAs would maintain channel integrity and processes. As discussed below, large wood delivery in treated stands would be affected, but in the long-term more closely resemble historic conditions. Due to the limited amount of treatment spatially, such changes would probably not be measurable at the watershed scale. Project road treatments would reduce the delivery of sediment in the long term and therefore improve channel processes linked to sediment. Changes would most likely be detectable at the site of treatments (channel reaches currently affected by road crossings). Given the extreme variation in the sources, timing and delivery of sediment, it is unlikely that changes would be measurable at the watershed scale. The overall result of project activities would most likely be a reduction in chronic delivery of sediment to channels (due to treatments of road crossings and surfaces). Because flow regimes would not be affected, the transport of sediment in channels would not likely be affected.

3. Maintain or restore in stream flows to support desired riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges.

Because natural flow regimes are extremely variable and relatively small portions of project area watersheds would be treated with the proposed action, it is unlikely that changes in flow would be detectable at the watershed scale. The likely response is a short-term increase in soil moisture in treated stands with no measurable flow changes in stream channels. Changes in stream stability and function can be related to interactions between changes in land use and peak flows. There is low risk of changes in peak flow from proposed activities. Reasoning for this expected result is based on several factors. First, the total amount of road surface in the project watersheds would be reduced by about 16 miles by the proposed action. Roads have compacted surfaces that can contribute runoff, and often include drainage structures (ditches, relief culverts, etc.) that increase the drainage network and more efficiently deliver (concentrate) flow to channels. It is not evident that channels are currently experiencing significant increased peak flows. No new roads would be constructed (the proposed action would reduce the number of roads slightly) but the overall result of treatments would not result in detectable changes at the watershed scale. Fuels and other vegetation management activities would not measurably increase soil compaction (see Creeks II Soil Resources Report); therefore runoff at the site scale would not be significantly increased.

4. Maintain or restore the natural timing and variability of the water table elevation in meadows and wetlands-

It is likely that aspen treatments will result in raising water tables in treated areas. Aspen typically have lower transpiration rates than competing coniferous vegetation. Outside these areas, it is unlikely that changes in the timing and variability of water table elevation in meadows and wetlands would result from proposed activities. The rationale is similar to that discussed above for flow regime, channel stability, and stream function. The overall amount of road induced runoff from compacted road surfaces within watersheds would decrease slightly. Furthermore, upslope soil moisture in treated stands would increase over the short term due to a reduction in evapotranspiration in thinning and group selection units. Direct impacts to meadows and wetlands that could affect the timing and variability of the water table would be avoided through the implementation of mechanical exclusion zones and Best Management Practices.

5. Maintain or restore the diversity and productivity of native and desired non-native plant communities in the riparian zone-

The silvicultural and prescribed fire treatments are designed to promote tree vigor, thus increasing productivity through the thinning of overstocked and unhealthy trees. In addition, white fir would be thinned or removed allowing for increased species richness. Through selective thinning, more light would penetrate to the forest floor and improve conditions for riparian shrub and tree species. In aspen treatment areas, aspen regeneration and survival would be improved. Thinning treatments within RHCAs outside of aspen units would not cut or remove riparian species, so those species are favored.

6. Maintain or restore riparian vegetation to provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems–

Within much of the RHCAs, the existing conifer stands are both overstocked and are relatively even aged. Thinning of the conifers would allow the remaining trees to reach larger sizes sooner, increasing the potential for delivery of larger trees to aquatic habitats in the long term. The likely long-term result is delivery of fewer, larger pieces of wood from treated areas that more likely represents conditions in which channels and communities evolved. In areas treated for aspen enhancement, delivery of large woody debris would more closely mimic rates that existed prior to fire suppression and range management activities that impacted the aspen communities.

7. Maintain or restore habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian plant communities.

The proposed treatments are designed to increase the diversity and overall health of the riparian community and to reduce the effects of wildfires and enhance aspen. Treatments within riparian zones would move the riparian community toward a more historic composition, providing the opportunity for native flora and fauna to trend towards a more natural condition.

8. Maintain or restore riparian vegetation to provide adequate summer and winter thermal regulation within the riparian and aquatic zones–

As discussed above, the treatments are intended to restore diversity and vigor to the vegetative species in the riparian and zone. Treatment within RHCAs would create stand conditions that favor aspen regeneration and are more resilient to wildfire. Furthermore, treated stand conditions should result in thermal conditions at the site scale closer to those with which native communities evolved. At the stream reach, watershed and project scale, treatments are not extensive enough to result in a measurable change from existing conditions.

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Appendix E - Cumulative Effects

Past, Present and Reasonably Foreseeable Future Actions -List of Cumulative Actions

This section summarizes the analysis area and the temporal scale (time) considered for the cumulative effects analysis. Each resource analysis has disclosed the specific cumulative effects for that particular resource area. Refer to the applicable EIS sections for a specific discussion of cumulative effects.

Scope of the Cumulative Effects Area

The cumulative effects area would be at a minimum the project area. In addition, some resources would use a larger cumulative effects area such as subwatersheds. The time period used for including past actions is 25 years before present (1985-2010), and 30 years for cumulative watershed effects analysis.

Past, Present and Reasonably Foreseeable Future Actions

The following list of cumulative effects actions is considered for this project. Maps showing these activities in relationship to the project area follow the tables. Table 102 through A-5 summarize those past, ongoing and foreseeable future actions, with a description of the activity and the acres affected. Guidance on cumulative effects, in particular, past actions, was considered, based on Connaughton (2005), here by incorporated by reference. In addition, those areas considered for cumulative effects are shown in Figure 32 - Figure 35.

Table 102. List of past vegetative management actions - (see Figure 33)

Activity Name	Year	Activity Description
Eagle TS	1981	Timber harvest on 700 acres using the following silviculture treatment: Intermediate Sanitation on 700 acres.
Grizzly Creek TS	1983	Timber harvest on 585 acres using the following silviculture treatment: Overstory Removal on 585 acres.
Grizzly 97% Resale	1983	Timber harvest on 597 acres using the following silviculture treatment: Intermediate Thinning (thin from above) on 597 acres.
Miller Creek TS	1983-1984	Timber harvest on 180 acres using the following silviculture treatments: Intermediate Sanitation on 50 acres; Overstory Removal on 28 acres; Regeneration Clearcut on 92 acres; and Seed Step Shelterwood on 10 acres.
Happy Days TS	1985	Timber harvest on 669 acres using the following silviculture treatments: Intermediate Sanitation on 535 acres; Overstory Removal on 23 acres; and Regeneration Clearcut on 111 acres.
Basin TS	1986-1987	Timber harvest on 589 acres using the following silviculture treatments: Intermediate Sanitation on 71 acres; Intermediate Thinning (thin from above) on 15 acres; and Seed Step Shelterwood on 503 acres.
Kay TS	1986-1987	Timber harvest on 570 acres using the following silviculture treatments: Overstory Removal on 570 acres.
Lemm Ranch TS	1987	Timber harvest on 534 acres using the following silviculture treatments: Intermediate Sanitation on 456 acres; Overstory Removal on 30 acres; and Regeneration Clearcut on 48 acres.
Fanani TS	1987-1988	Timber harvest on 497 acres using the following silviculture treatments: Intermediate Sanitation on 63 acres; Overstory Removal on 100 acres; Regeneration Clearcut on 142 acres; and Seed Step Shelterwood on 192 acres.

Activity Name	Year	Activity Description
Robbersroost TS	1987-1989	Timber harvest on 683 acres using the following silviculture treatments: Overstory Removal on 546 acres; and Regeneration Clearcut on 137 acres.
Hollow Middle TS	1993	Timber harvest on 484 acres using the following silviculture treatments: Overstory Removal on 484 acres.
Ruffa TS	1985	Timber harvest on 1,087 acres using the following silviculture treatments: Intermediate Sanitation on 1,029 acres; and Overstory Removal on 58 acres.
Ruffa TS	1998	Timber harvest on 728 acres using the following silviculture treatments: Intermediate Sanitation on 78 acres; Multiproduct Thinning (thin from below) on 297 acres; and Prep Step Shelterwood on 353 acres.
Shanghai Fannani TS	1993-1998	Timber harvest on 1,186 acres using the following silviculture treatments: Intermediate Sanitation on 278 acres; Multiproduct Thinning (thin below) on 848 acres; and Prep Step Shelterwood on 68 acres.
Mudhole TS	1997-1999	Timber harvest on 1,217 acres using the following silviculture treatments: Intermediate Sanitation on 109 acres; and Multiproduct Thinning (thin from below) on 1,108 acres.
Little Grizzly TS	1989-1990	Timber harvest on 532 acres using the following silviculture treatments; Overstory Removal on 60 acres; Regeneration Clearcut on 25 acres; and Seed Step Shelterwood on 447 acres.
Castle TS	1989-1992	Timber harvest on 989 acres using the following silviculture treatments: Intermediate Sanitation on 202 acres; Overstory Removal on 278 acres; Regeneration Clear Cut on 308 acres; and Seed Step Shelterwood on 201 acres.
Lost Tom TS	1991-1992	Timber harvest on 353 acres using the following silviculture treatments: Intermediate Sanitation on 81 acres; Overstory Removal on 258 acres; and Regeneration Clearcut on 14 acres.
Lost Lake TS	1999-2004	Timber harvest on 1,056 acres using the following silviculture treatments: Intermediate Sanitation on 279 acres; and Multiproduct Thinning (thin from below) on 777 acres.
Prattville DFPZ	2000-2003	Approximately 1,355 acres of DFPZ construction, treatment B.
Mudhole2 TS	2000	Timber harvest on 116 acres using the following silviculture treatment: Multiproduct Thinning (thin from below) on 116 acres.
Burned Out TS	2003	Timber harvest on 1,183 acres, Post Fire Restoration and Regeneration
Eagle Windthrow Fuels Reduction	2004	300 acres tractor removal of windthrown timber
West Shore DFPZ Project	2004	Approximately 775 acres of DFPZ construction, treatments A, B and C.
Fox Farm DFPZ Project	2005-2006	Approximately 760 acres of DFPZ construction, treatments A, B and C.
Jonesville OHV Warming Hut	2005	Construction of a warming hut along the Jonesville Snowmobile Route. Construction of a midpoint hut/restroom facility along the Yellow Creek road system.
Private Land Use	Pre 2000	10% Thin every 10 years.
Storrie Fire, 2-01-066-PLU	2001	Timber harvest on 2,840 acres using the following silviculture treatment: Post-Fire Restoration and Regeneration (Sanitation Salvage on 180 acres and Substantially Damaged Timberland on 2,660 acres) on 2,840 acres
Butt Creek, 2-02-115-PLU	2001	Timber harvest on 3,654 acres using the following silviculture treatment: Selection thinning on 3,654 acres.
Yellow THP, 2-02-168-PLU	2002	Timber harvest on 2,045 acres using the following silviculture treatment: Sanitation Salvage on 93 acres, Shelterwood Removal on 1,440 acres, and Clearcut on 188 acres.

Activity Name	Year	Activity Description
Coyote THP, 2-02-229-PLU	2002	Timber harvest on 1,176 acres using the following silviculture treatment: Selection on 930 acres, Commercial Thinning on 130 acres, Alternative (closest to a clearcut) on 96 acres, Clearcut on 19 acres and Other on 1 acre.
Bonanza THP, 2-04-040-PLU	2004	Timber harvest on 5,297 acres using the following silviculture treatment: Selection on 5,147 acres and Group Selection on 150 acres.
Piper THP, 2-04-109-PLU	2004	Timber harvest on 65 acres using the following silviculture treatment: Shelterwood Removal step on 65 acres.
Collins Pines, 2-05-141-PLU	2005	Timber harvest on 3,078 acres using the following silviculture treatment: Group Selection on 3,064 acres and Clearcut on 14 acres.
Humbug Valley, 2-07-074-PLU	2007	Timber harvest on 272 acres using the following silviculture treatment: Selection step on 64 acres.
Peacock THP, 2-08-070-PLU	2008	Timber harvest on 1,035 acres using the following silviculture treatment: Group Selection on 1,025 acres.
Collins Pines, 2-08-022-PLU	2008	Timber harvest on 1,236 acres using the following silviculture treatment: Group Selection on 1,236 acres.

Source: Almanor Ranger District Records and CDF database/records

Table 103. Summary of Table 102 acres of past vegetative management actions by treatment type

Treatment Type	Acres Treated
Forest Service Activities	
Prep Step Shelterwood	421
Intermediate Thinning (thin from above)	612
Regeneration Clearcut	877
Windthrown Fuels Reduction	300
Post Fire Restoration and Regeneration	1,183
Seed Step Shelterwood	1,353
Multiproduct Thinning (thin from below)	3,146
Intermediate Sanitation	3,931
Overstory Removal	3,020
DFPZ	2,890
Private Activities	
Other	1
Selection Step	64
Sanitation Salvage	93
Alternative (closest to a clearcut)	96
Commercial Thin	144
Clearcut	207
Shelterwood Removal	1,505
Post-Fire Restoration and Regeneration	2,840
Group Selection	5,475
Selection Thinning	9,731

Table 104. List of ongoing actions (see Figure 33)

Activity Name	Year	Activity Description
Storrie Wildfire Event Storrie Post-Fire Project (see Figure A-2)	2000-ongoing	Total Acres Burned: 56,060; NFS Acres: 52,035; Private: 4,026. The Storrie Post-Fire Restoration Project EA (2002) states that approximately 27,000 acres were on the Lassen National Forest (Almanor RD), of which approximately 21,000 acres were in HFQLG Off-Base area. From 2000 to 2003 approximately 1,200 acres of National Forest were harvested (Partially listed in Past Activities as Burned Out TS). According to the 2009 Supplemental Information Report for the Storrie Post-Fire Restoration Project EA, approximately 1,700 acres of National Forest will continue to be treated until 2012. Adjacent Private landowners logged all of their fire affected lands (approximately 5,300 acres within three sub-watersheds in/adjacent to Creeks II project, listed in Private THPs) in the fall of 2000 and early summer of 2001, and planted in 2002.
Rust Resistant Sugar Pine Enhancement	2010-ongoing	Approximately 34 acres of mechanical and hand treatment (close to multi-product thinning or thin from below).
Sierra Pacific Industries, 2-10-037-PLU	2010-ongoing	Timber harvest on 235 acres using the following silviculture treatment: Shelterwood Cut on 235 acres.
Trail Maintenance	ongoing	Pacific Crest National Scenic Trail, Soda Creek Trail, Belden Trail, and Indian Springs Trail: This work typically includes, logging out of the trail tread, brushing, hazard tree removal, constructing, reconstructing, maintaining trail tread, waterbars or other erosion control devices, installing and maintaining signs. This work would be accomplished by a combination of force account crews, volunteers, and contractors from May 15 through October 15 annually.
Road Maintenance	ongoing	Annual road maintenance, grading of roads and ditches, culvert cleanout, hazard tree removal, maintaining and installing signs...
Plantation Maintenance	ongoing	Almanor Ranger District; Creeks Planning File
Special Uses	ongoing	Annually waterlines are replaced as needed, weather stations are maintained for access and fire protection, hazard trees and sub-merchantable material removed, and fire clearance is maintained. Recreation events include: snowmobile poker runs, equestrian endurance rides, and Boy Scouts of America outings.
Mining operations	ongoing	No Plans of Operation or Notices of Intent to Operate are currently filed Inquires for mining operations are received on an ongoing basis, typically for Yellow Creek.
Grazing Allotments and Permits	ongoing	Soda Creek/North Butte Allotment is authorized for 27 cow/calf pairs (on), 27 (off), for a total of 54 head from 6/16 to 9/15 annually. Total authorized use is 218 AUMs on both private and NFS administrated lands. Butt Creek, Soldier Meadows, and West Humbug Allotments are closed or vacant.
Post Poles; Christmas Tree; Fuel Wood Use	ongoing	Use is common in project area.
Timber harvest on private lands	ongoing	Estimated as 80 year rotation, using 20 to 80 percent single selection treatment and 20 to 80 percent clearcut treatment depending on owner.
Recreation Maintenance	ongoing	Hazard tree removal, fire rings removed, signs installed, and sites closed to use within 100' of water sources.
OHV, Mountain Bikes, Hiking, Hunting, Fishing, Dispersed Camping, Camping Use, Trail Rides, Snowmobile use and recreational gold panning	ongoing	Recreation use by the public is common.

Source: Almanor Ranger District Records

Table 105. Summary of Table 104 acres of ongoing vegetative management actions by treatment type

Treatment Type	Acres Treated
Commercial Thinning (thin from below)	34
Post-Fire Restoration and Regeneration	1,700
Shelterwood cut	235

Table 106. Detailed list of ongoing range allotments (see Figure 35)

Allotment Name	Livestock Class	Livestock Kind	Livestock Number	Season of Use	AUMs	Status
Butt Creek	Cattle	Cow/Calf	70	6/1-9/30	371	Closed
Soldier Meadows	Cattle	Cow/Calf	20 on 200 off 220 total	6/1-9/30	106 1,059 1,164	Closed
Soda Creek/North Butte	Cattle	Cow/Calf	27 on 27 off 54 total	6/16-9/15	109 109 218	Active
West Humbug	Cattle	Cow/Calf	30 on 670 off 700 total	6/1-9/30	161 3,597 3,758	Vacant

Source: Almanor Ranger District 2230 Permit Files Source: Almanor Ranger District Planning Files

Table 107. List of reasonably foreseeable future actions - (2012-+) (see Figure 33)

Activity Name	Year	Activity Description
Timber harvest on private lands	annually	Estimated at 80 year rotation, using 20 to 80 percent single selection treatment and 20 to 80 percent clearcut treatment depending on owner.
Grizzly Restoration	2012+	Timber harvest on 130 acres using the following silviculture treatment: Mechanical thinning to various canopy cover and radial release of pine and oak.
Soda Underburn	2012+	Broadcast burn on 8,000 acres within Storrie Fire Perimeter. Low intensity understory burn for maintenance of fire rehabilitation areas.

Table 108. Summary of Table 107 acres of reasonably foreseeable future actions by treatment type

Treatment Type	Acres Treated
Mechanical Thinning and Radial Release	130
Broadcast Burn	8,000

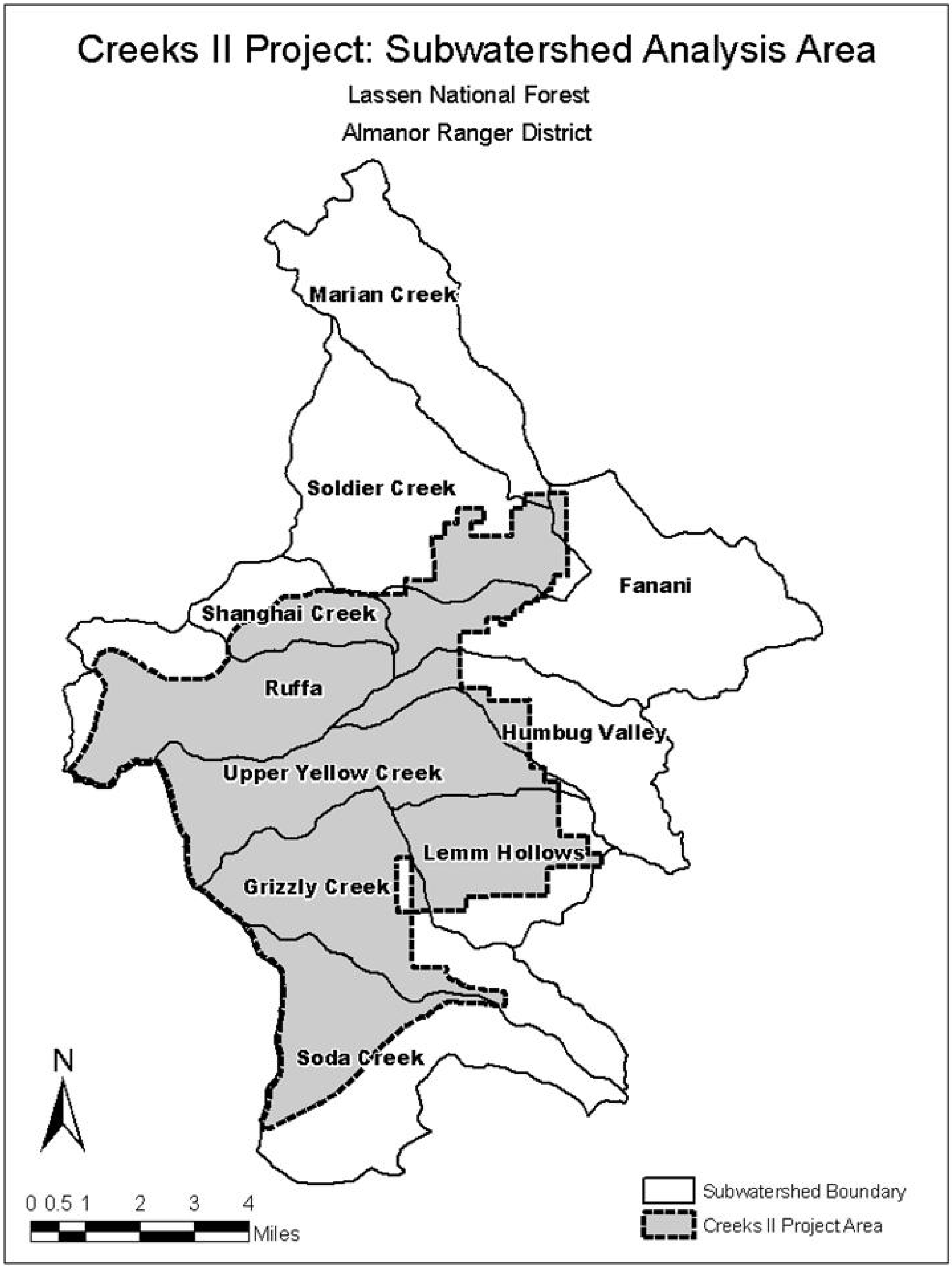

Figure 32. Creeks II subwatershed analysis area

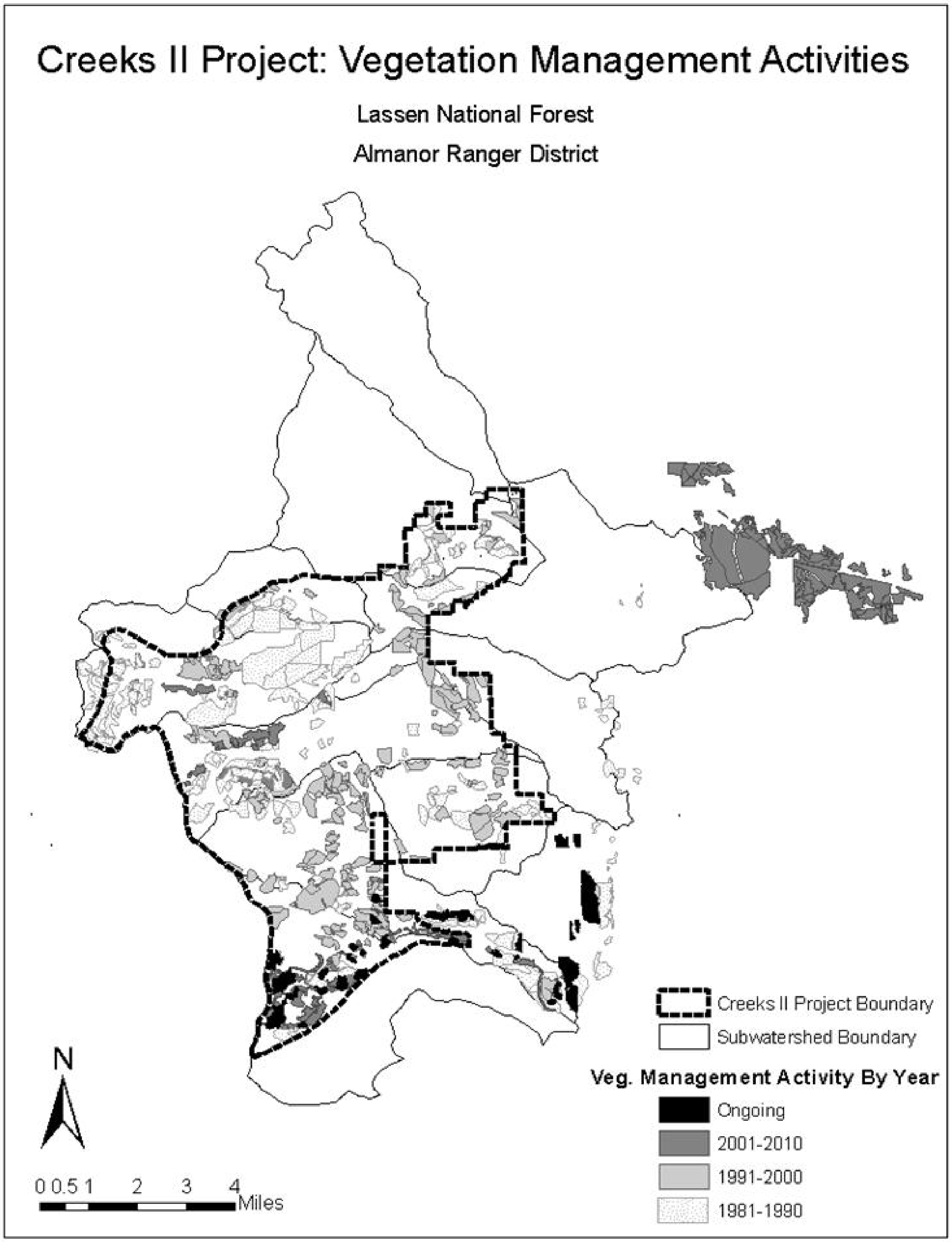

Figure 33. Creeks II past, present and reasonably foreseeable vegetation management activities

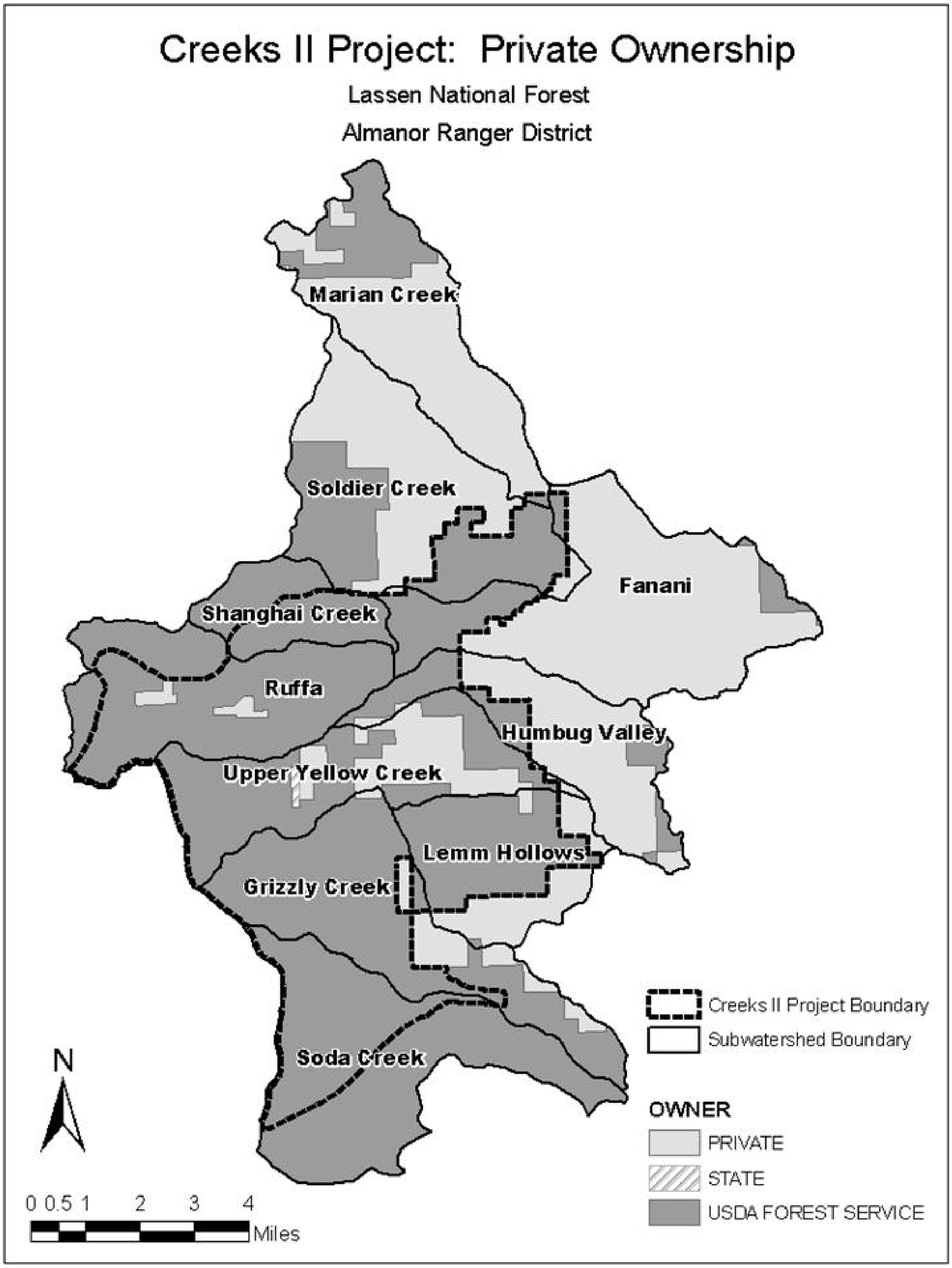

Figure 34. Creeks II project area land ownership

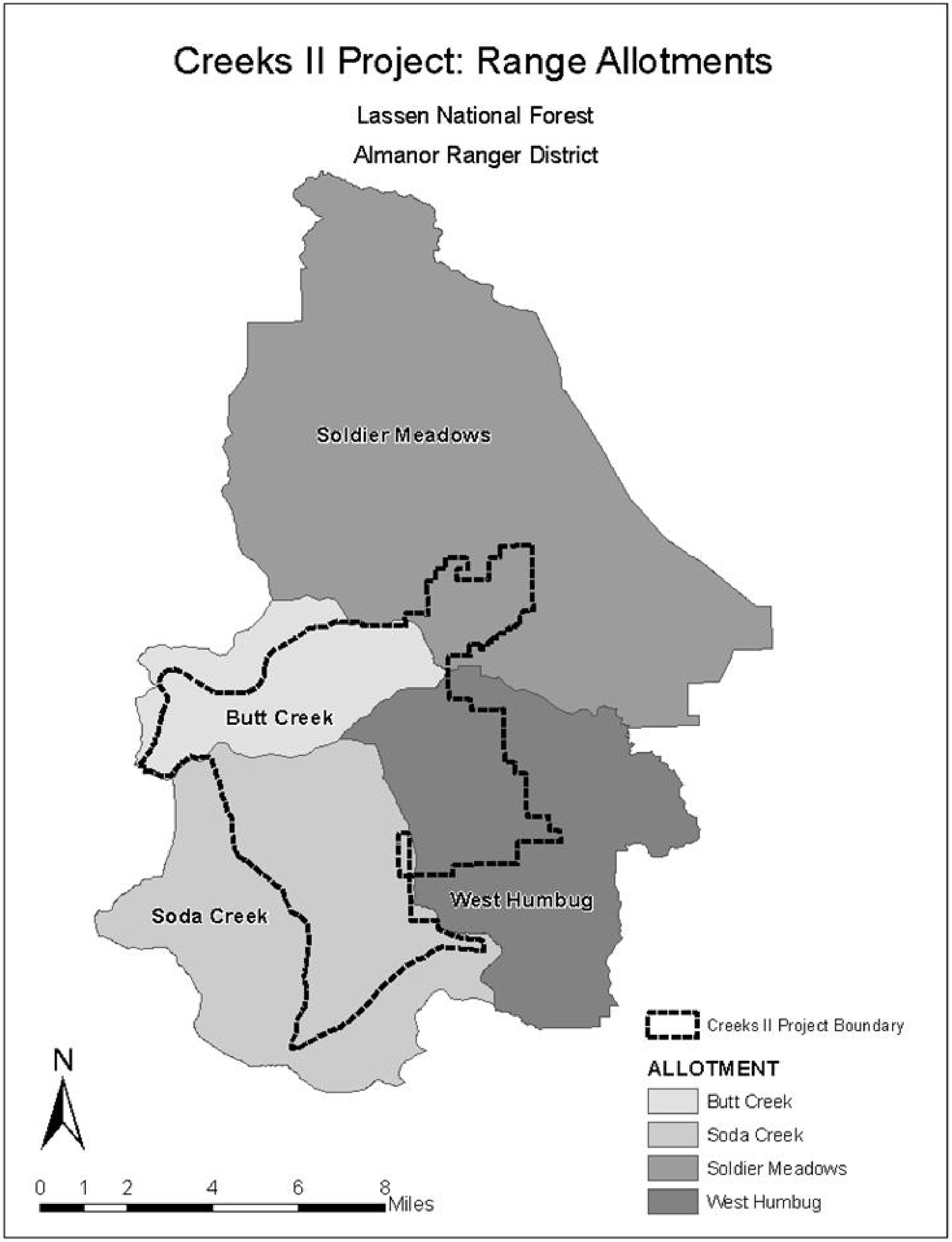

Figure 35. Creeks II project area range allotments

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Appendix F - Monitoring Plan

Introduction

This monitoring plan is intended to address the measurement indicators as outlined in the Creeks II Forest Restoration Project proposed action. The measurement indicators were established as a way to measure or track the outcomes of the eight project objectives. The table below summarizes the project objectives and the measurement indicators associated with them.

Creeks II Project Objective	Measurement indicators	Monitoring Elements
1. Improve tree vigor, growth, and insect and disease resistance by reducing stand densities and by favoring the retention and development of pine species.	Tree species, composition, stand density, and structure.	A. Stand Exam data collection
2. Protect forest ecosystems from high-intensity, stand-destroying wildfires and provide safe locations for fire-suppression personnel.	Flame length, fire type, fuel loading, crown, bulk density, and canopy base height.	B. Fire and Fuels modeling C. Ground fuels data collection
3. Implement economically efficient treatments to reduce hazardous fuels and contribute to community stability.	Revenues and costs associated with management activities. Jobs and income created by the Creeks II project.	D. Revenues generated by Creeks II
4. Retain and promote habitat connectivity and stand heterogeneity for late –seral wildlife.	Tree species composition and stand density. Late seral habitat attributes and connectivity for forest carnivores (marten). Percentage of pine in the project area. Promote and retain large tree and habitat attributes important to late-seral species.	E. Stand Exam data collection F. Marten habitat data collection G. Large Pine Vigor
5. Increase heterogeneity and diversity within size class 4 stands.	Tree species composition, stand structure, and age class distribution within the project area.	H. Stand Exam data collection
6. Promote the health of aspen stands.	Acres of aspen stands effectively treated and tree species composition in treated stands.	I. Aspen regeneration response and browse intensity data collection
7. Improve watershed condition	Cubic yards of sediment reduced. Road density reduced.	J. Cumulative Watershed Analysis modeling
8. Improve Vegetative Condition within Riparian Habitat conservation Areas (RHCAs) to meet Riparian Management Objectives	Change in tree species composition and stand density. Retention of key ground cover and canopy cover. Promote and retain large tree.	K. Stand Exam data collection L. Understory Vegetation response

Stand Exam data collection (A, E, H and K)

Monitoring Objective: To measure the change in tree species composition, stand density, size class distribution (i.e. stand structure) and canopy cover as a result of silvicultural treatments within DFPZs, area thins and RHCA prescriptions.

Design: Standardized R5 Stand exam methods will be used. Data will be collected prior to treatment to establish existing condition. Permanent fixed plots will be used in order to compare data before and after treatment. A series of standardized nested plots will be used to measure tree species composition, basal area, canopy cover, size class distribution and dominance classes.

Frequency: Data will be collected one year prior to treatment then one growing season after treatment is completed and again 3 and 6 years post treatment.

Responsibility: This monitoring will be the responsibility of the District Silviculturist.

Adaptive Management: Results will be reported to the district ranger in a way that allows for the data to be summarized and utilized in future projects. These results will provide a basis for the outcomes of specific silvicultural prescriptions and their effectiveness in retaining key late seral habitat attributes, pine species retention, stand densities, and heterogeneity. Future silvicultural treatments will be improved upon based on the results of this monitoring.

Fire and Fuels Modeling (B)

Monitoring Objective: To determine how fire behavior may change as a result of silvicultural and fuels treatments within DFPZs and Area thins.

Design: Forest vegetation simulator fire and fuels extension (FVS FFE) model outputs will include flame length, fire type, fuel loading, and canopy base height.

Frequency: Modeling will be used to inform the Creeks II fuels analysis and proposed action development. Various versions may be done to show different results based on a variety of fire weather conditions.

Responsibility: The District Fuels officer is responsible for the fuels models.

Adaptive Management: N/A

Ground Fuels (C)

Monitoring Objective: To measure the change in existing ground fuels and future fuel accumulations within DFPZ and Area thin treatment types.

Design: Standardized Browns transect methods will be used. Plots will be selected randomly and will be established prior to project implementation to establish the existing ground fuels condition. To reduce variability in data collection, transects will be permanent plots and revisited after treatment.

Frequency: Transects will be collected one year prior to treatment and immediately after. Further data collection may occur in subsequent years if necessary to determine fuels accumulations through time.

Responsibility: The District Fuels Officer will be responsible for the collection of ground fuels data.

Adaptive Management: Fuels monitoring results will be summarized and reported to the District Ranger and utilized to determine if the projects fuels reduction objectives were met.

Revenues Generated (D)

Monitoring Objective: To track the economics (costs and revenues) of the Creeks II project including timber sales and service contracts used to meet the project objectives.

Design: The Creeks II project will include a series of timber sale contracts as well as service contract to complete the project. These contracts have costs and revenues associated with them and they will be tracked and reported to the District Ranger once completed.

Frequency: Costs and revenues will be tracked until project completion.

Responsibility: The District Silviculturist is responsible for the project economics tracking.

Adaptive Management: N/A

Marten Habitat (F)

Monitoring Objective: To measure the changes in key marten habitat attributes as a result of silvicultural treatments within suitable marten habitat.

Design: Data will be collected prior to project implementation at all marten rest, den and morality sites three times along a GPS track and stratified at random points in structurally open, simple, and complex patches. The data will include basal area, tree species, canopy cover, shrub and herbaceous cover, large wood y material, CWHR stand type, CWHR density and CWHR size class, tree dominance and forest pathogens.

Frequency: Data will be collected prior to project implementation and then one year post.

Responsibility: The District Wildlife Biologist and PSW researchers are responsible for this monitoring element.

Adaptive Management: The results of this monitoring will be reported to the District Ranger and used to inform future silvicultural prescriptions in suitable marten habitat.

Large Pine Vigor (G)

Monitoring Objective: To determine how large pine trees respond to silvicultural treatments in the project area.

Design: A sample of large sugar, ponderosa or Jeffery pine trees (all > 30 in d.b.h.) will be monitored within treatment units that contain a silvicultural element to retain and or increase pine species. Basal area, tree vigor class and insect and disease data will be collected at each tree prior to treatment and after treatment. Basal area data will help to track the change in tree competition immediately surrounding the tree before and after treatment. These trees will be part of a greater sampling across the Lassen National Forest as part of the R5 insect and disease program.

Frequency: Data will be collected prior to treatment, one year after and again six years post treatment. The trees will be tracked for at least six years after treatment at which time a core sample will be collected to determine if tree growth changed after treatment.

Responsibility: The District Ecologist is responsible for the collection of this data and reporting it to the R5 Insect and Disease group.

Adaptive Management: Results of this monitoring effort will be used to assess the effects of various types of treatments involving pine species across the Lassen National Forest. They will help to adapt future silvicultural prescriptions for the enhancement of pine species across the forest.

Aspen Regeneration Monitoring (I)

Monitoring Objective: To measure aspen sprout density after conifer removal treatment and the intensity and frequency of browse on aspen sprouts.

Design: A subset of aspen stands will be monitored before and after treatment to determine if fencing is needed to protect new shoots from grazing livestock or browsing deer. A standardized method of implementation monitoring will be used to measure aspen stem density along a transect, change in canopy cover, and amount of browse. One to three 100 ft by 3 ft transects will be permanently marked within a given stand. Photos will be taken at the transects as a visual reference. Data will be collected in late summer or fall after deer and livestock browse becomes evident.

Frequency: Initially data will be collected one year prior to treatment and one growing season after. If browse is determined to exceed the browsing limitations as described in the SNFPA an appropriate fence (either deer or livestock depending on which herbivore is consuming the aspen) will be constructed. Once fencing is constructed data may be collected to determine the effectiveness of the fence. In stands that were not determined to have a browse problem in the first year post conifer removal then data may be collected in subsequent years to track the stands density.

Responsibility: Aspen regeneration monitoring will be the responsibility of the District Ecologist.

Adaptive Management: The results one year after treatment will be used to determine if further management is necessary to meet the project objectives i.e. fence installation.

Cumulative Watershed Modeling (J)

Monitoring Objective: Assess change in sediment production from native surfaced roads, streams crossings, and vegetation treatment areas to aquatic habitats within the project area.

Design: 1) Utilize the WEPP model to determine sediment reductions as a result of transportation improvement actions and stream channel upgrades. 2) Conduct best management practices effectiveness program monitoring (BMPEP). 3) Conduct post project implementation Stream Condition Inventory (SCI) at pre established survey reaches to assess changes in stream channel morphology and aquatic habitat attributes.

Frequency: 1) WEPP modeling would occur once all proposed project activities have been implemented and have over-wintered. 2) BMPEP monitoring would occur once all proposed project activities have been implemented and have over-wintered. 3) SCI monitoring would occur one year following implementation of all proposed actions have been completed within each subwatershed where predetermined SCI reaches have been established.

Responsibility: This data is the responsibility of the District Hydrologist and District Fish Biologist.

Adaptive Management: Data will be used to inform future transportation improvement actions, implementation of BMPs, and vegetation treatment prescriptions within RHCAs. This data will be a part of a larger data set that includes treatments within aspen, meadows and silvicultural prescriptions across the Lassen national forest. The results will be reported to the line officer upon completion.

Additional Monitoring not associated with Measurement Indicators:

Water Quality Monitoring

Locations: Monitoring should occur at sites where near-stream riparian treatments are implemented, for all high risk activities and in subwatersheds where equivalent roaded acres are approaching the threshold of concern. High-risk activities include road construction or reconstruction, stream crossings, grazing, and all ground-disturbing activities within designated riparian buffers, including riparian reserves, riparian conservation areas, riparian habitat conservation areas, and streamside management zones. Development and completion of BMP checklists should occur before ground disturbance begins and as needed, based on weather conditions and project activities.

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Glossary

active crown fire	The independent movement of flames from a fire through the branches and top of the trees.
age class	A distinct aggregation of trees originating from a single natural event or regeneration activity.
allelopathic	The suppression of growth of one plant species by another due to the release of toxic substances.
area thinning	See thinning
basal area	The combined area of the cross sections of tree boles at a height of 4.5 feet above the ground, generally given as square feet per acre.
biomass	Limbs and foliage (parts of trees other than logs) that can be collected, chipped, or ground; exported from the forest; and used for power production or manufacture of wood fiber products.
bole	The main stem of a conifer tree, which becomes a log or logs when the tree is cut.
California Wildlife Habitat Relationships (CWHR)	A system developed jointly by Forest Service Region 5 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. The CWHR system has three elements: (1) major tree-dominated vegetation associations, (2) tree size, and (3) canopy cover. Tree size and canopy cover classes are:

Tree Size Classes

1 = Seedling (less than 1 inch d.b.h.)
2 = Sapling (1–6 inches d.b.h.)
3 = Pole (6–11 inches d.b.h.)
4 = Small (11–24 inches d.b.h.)
5 = Medium/Large (greater than 24 inches d.b.h.)
6 = Multilayered (size class 5 over a distinct layer of size class 3 or 4, total canopy greater than 60-percent closure). In this EIS, class 6 is included in class 5.

Canopy Cover Classes

S = Sparse Cover (10–24 percent canopy closure)
O = Open Cover (25–39 percent canopy closure)
M = Moderate Cover (40–59 percent canopy closure)
D = Dense Cover (greater than 60 percent canopy cover)

canopy	The branches and foliage of trees (as distinct from the stem or bole).
canopy base height	The lowest height of canopy above the ground where there is sufficient canopy fuel to spread fire vertically.

canopy cover	The ground area covered by tree crowns, or the degree to which the canopy blocks sunlight or obscures the sky, expressed as a percent of ground area; also referred to as canopy closure or crown cover.
chain	A chain is a measurement of distance. One chain = 66 feet.
Community Wildfire Protection Plan (CWPP)	A plan that is collaboratively developed among federal, state, and private shareholders to outline the risks and hazards associated with wildland fire threats to local communities. The plan includes recommended mitigation measures to protect the public, firefighters, natural resources, and private property. A key part of the CWPP planning process is to identify "communities-at-risk" (a community at risk from a wildfire originating on public lands) and boundaries of the WUI.
crown	See canopy.
crown cover	See canopy cover.
decommission	Closing a road to mechanical use and returning the road to a natural or semi-natural condition. This could include removing stream crossing fills and structures (e.g., culverts or bridges), re-ontouring to natural topography obliteration (e.g., replacing fill slope material against cut slopes), surface shaping (e.g., constructing in-road water bars), and/or surface scarification.
defensible fuel profile zone (DFPZ)	A strategically located strip of land approximately ½ mile wide on which fuels, both living and dead, have been modified in order to reduce the potential for sustained crown fire and flame length. The main purpose of a DFPZ is to reduce wildfire intensity and rate of spread and to provide fire suppression personnel a safer and more effective location from which to take action.
diameter at breast height (d.b.h.)	The diameter of a tree measured at 4.5 feet above the ground on the uphill side.
direct attack	A method of suppression that treats the fire as a whole, or all its burning edge, by wetting, cooling, smothering, or by chemically quenching it or mechanically separating it from unburned fuel. A suppression strategy in which resources are directed to work close to the fire edge.
dripline	The perimeter of the vertical projection of a tree canopy upon the ground.
duff / duff layer	Decaying leaves and branches on the forest floor.
effective ground cover	The amount of ground cover left after the fire; it is expressed in percent.
endemic	In the context of this environmental impact statement, refers to localized pockets within a small area, such as a pocket within a stand or a small stand.

Equivalent Roaded Acres (ERA) Disturbance from past, present, currently proposed, and foreseeable future project activities within a sub-watershed are estimated using equivalent roaded acres by relating the relative magnitude of the activities to an acre of road disturbance. This is accomplished by applying “disturbance” coefficients to each type of ground-disturbing activity. Under this method each affected sub-watershed is given a threshold of concern value based on watershed sensitivity indicators (soils, slopes, unstable lands, beneficial uses at risk, etc.). The closer the calculated equivalent roaded acres value for the sub-watershed is to the threshold of concern, the higher the risk of adverse cumulative impacts to watershed and aquatic resources at the sub-watershed scale. Disturbance from activities on private lands within the project area was factored into the model using information contained within timber harvest plans obtained from CALFIRE (Northern Region Headquarters, Redding, CA).

fire frequency The average number of years between fires.

fire regime condition class A classification of the amount of departure from the natural fire regime. Assessing fire regime and condition class can help guide management objectives and set priorities for treatments.

fire type A description of how a fire burns, such as on the forest floor (surface) or in the tree crowns. Fire type represents the intensity of the fire.

> **surface fire** burns only the fuels at or near the surface without torching the trees above—this is the desired condition.
>
> **passive crown fire** torches out individual or small groups of trees as the surface fuels burning under them provide the convective heat to ignite the above-ground fuels.
>
> **active crown fire** is spread from tree to tree in conjunction with the convective heat of the surface fuels burning under them.

flame length The length of flame measured in feet. Increased flame lengths increase resistance to control and likelihood of torching events and crown fires.

fuel bed The fuels both living and dead that are available to burn.

fuel loading The amount of fuel (vegetative matter both living and dead) present at a given site; usually expressed in tons per acre. This value generally refers to the fuel that would be available for consumption by fire.

fuel model A mathematical representation of a fuelbed, that includes fuel depth, fuel load (<3 inch fuel), heat content, and surface:volume ratio.

group selection A group selection is an area ¼ to 2 acres that is cleared of trees. This area creates an opening in the forest canopy(called groups) that allows for the establishment of a more diverse community of plants; from the reintroduction of brush to the regeneration of pine species.

groups Openings ¼ to 2 acres in size created by group selection.

grubbing Removal of vegetation at or below ground level with hand tools.

guild	Used to group plant species that use similar resources in a similar way. Plant species in the same guild are found in similar habitat types and have similar environmental requirements.
hand piling	Piling branches and limbs from tree harvests or thinnings by hand for burning at a later time.
hand line	Fire lines created by forest workers using shovels and hand tools to remove organic materials and expose mineral soil. The line width generally ranges between 2 and 3 feet.
Healthy Forest Restoration Act (2003)	An act that directs agency personnel to improve forest conditions through fuels reduction activities.
Healthy Forest Initiative (HFI) Act (2002)	Provides administrative reform to aid in accomplishing fuels reduction activities.
home range core area (HRCA)	Mapped foraging area.
hydrologic unit code	HUC is an acronym for Hydrologic Unit Code. Hydrologic unit codes, are a way of identifying drainage basins, or watersheds, in the United States in a nested arrangement from largest (Regions - HUC-2) to smallest (Sub-Catchments - HUC-8).
indirect attack	A method of suppression in which the control line is mostly located along natural firebreaks, favorable breaks in topography (ridge tops, lakes, rock outcroppings), or at a considerable distance from the fire, and all intervening fuel is backfired or burned out.
indirect economic impact	An effect that occurs when supporting industries sell goods or services to directly affected industries.
individual tree selection (ITS)	A type of tree harvest designed to prevent the spread of insects and disease, reduce overstocking, and generally improve or maintain health of forest stands.
initial attack	The actions taken by the first resources to arrive at a wildfire to protect lives and property, and prevent further extension of the fire.
Interdisciplinary Team (ID Team)	The team of Forest Service resource specialists involved in project planning and analysis. T
ladder fuel	Shrubs or trees that connect fuels at the forest floor to the tree crowns.
landings	Forested openings that are cleared of vegetation, leveled, and graded and used to store (deck) logs and eventually to load log trucks for haul to the mill.
leave trees	The trees that are purposefully left in a stand that is thinned or harvested.
mastication	Mechanical grinding of harvest residue or thinnings; masticated material is usually left scattered on the harvest site.

matrix	The untreated area between group selections within a stand or treatment unit.
multilayer	Stand with three or more distinct foliage layers (canopies). Trees in the different layers may or may not be in the same age class.
mycorrhiza	The mutually beneficial association of a fungus and the roots of a plant, such as a conifer or an orchid, in which the plant's mineral absorption is enhanced and the fungus obtains nutrients.
natural fire regime	A general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but it also includes the influence of aboriginal burning (Agree 1993; Brown 1995).
90th percentile weather conditions	Hot, dry, and windy weather conditions that are exceeded only 10 percent of the time during fire season; 90th to 97th percentile conditions are considered *high*; 99th to 100th percentile are considered *extreme*.
operability	The ability to conduct vegetation management operations, which include construction of access roads and log landings, use of cable logging systems, clearing of central skid trails for tractor logging, and removal of trees that pose hazards to forest workers.
particulate matter	The general term used for a mixture of solid particles and liquid droplets found in the air. Some particles are large enough to be seen as dust or dirt. Others are so small they can be detected only with an electron microscope.
passive crown fire	The movement of fire through groups of trees; it usually does not continue for long periods of time.
percentile weather	The frequency of occurrence of a particular set of weather and fuel moisture conditions in the historical record for a given area. Extreme weather that occurs on10 percent of the days during fire season (June 1-September 30) is referred to as 90th percentile weather and is characterized by hot, dry winds, low humidity, and very dry fuels (Burkholder 2006). 90th percentile weather conditions are used in this analysis to predict fire behavior under these extreme fire weather conditions.
piling and burning	Piling harvest or thinning residues (branches and limbs) and burning them when moisture content has been reduced through evaporation, wildfire hazard is low, and atmospheric conditions are favorable for dispersal of smoke.
post fledgling area (PFA)	The area immediately surrounding the nest where recently fledged goshawks learn to hunt and it also provides cover for the young goshawks.
prescribed burning	Fire purposefully ignited to achieve a beneficial purpose, such as reducing fuels on the forest floor or fuels generated by logging or thinning forest trees.
present net value	Includes only the benefits and costs of producing primary outputs, excluding secondary benefits.

rate of spread	The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire. For this document, it is expressed as rate of forward spread of the fire front and is measured in chains per hour.
reconstruction	Rebuilding of an existing road in or adjacent to its current location to improve capacity and/or correct drainage problems.
regeneration	Tree seedlings and saplings that have the potential to develop into mature forest trees.
release	In the context of this environmental impact statement, giving large, old pines more space to grow, to “release” them from crowded conditions.
residual trees	Trees that are left to grow in a stand following treatment or fire.
resistance to control	The relative difficulty of constructing and holding a control line as affected by resistance to line construction and fire behavior; also called “difficulty of control.”
Riparian Habitat Conservation Areas (RHCA)	Zones of specified widths along streams and watercourses and around lakes and wetlands that vary according to stream or feature type, as described in the Scientific Analysis Team guidelines.
Scientific Analysis Team (SAT) Guidelines	This is a report written in 1993 on the viability assessments and management considerations for species associated with late-successional old-growth forests of the Pacific Northwest. These guidelines were adopted into the HFQLG final supplemental EIS.
stand density index (SDI)	This is a quantitative measurement that takes into account number of trees and total basal area of a stand, and equates them to a standardized numeric value, or SDI. This numeric value can be used to compare different stands and different treatments.
seral	Relating to a series of ecological communities formed in ecological succession.
shade intolerant	Species (such as ponderosa pine) that require full, open sunlight on the forest floor to establish and grow.
silviculture	A branch of forestry dealing with the development and care of forests.
size class	A classification of forest stands based on the average diameter of trees in the stand.
skid trail	A pathway traveled by ground skidding equipment while moving trees or logs to a landing. A skid trail differs from a skid road in that stumps are cut very low and the ground surface is mainly untouched by the blades of earth moving machines.
snag	A dead standing tree.
stocking	The number of regenerated trees per acre in a tree-harvest unit.
subsoiling	Performed after vegetation treatments, wherein mechanized equipment is used to till compacted soil to reduce soil compaction and consequent soil erosion.

surface fuels

The organic material at and/or immediately above the surface level of ground fuels, such as pine needle litter, dead and down woody material. For this analysis surface fuels are assessed in two size categories, 0-3 inches and greater than three inches. This is because fuels less than 3 inches in diameter are considered fine fuels and are most critical to fire ignition. Fuels 0-3 inches in diameter are typically fast-drying, dead fuels which ignite readily and are consumed rapidly when dry. This typically includes grass, leaves, draped pine needles, and small twigs. Fuels larger than 3 inches are larger down wood material that dries at a slower rate than the 0-3 inch material. Once ignited, these larger fuels burn at higher intensities and for longer duration than the smaller surface fuels.

thinning

Thinning involves removal of a portion of the trees on a site to reduce forest stand density, with the goal of increased growth rates, enhanced forest health, and reduced potential mortality.

Area thinning is a type of thinning intended to remove trees throughout the diameter classes up to 30 inches d.b.h to enhance stand diversity, leaving a complex stand structure with a reduced potential for fire to carry through the treatment area.

DFPZ thinning is a type of thinning intended to remove surface and ladder fuels to create a safe place for ingress and egress of fire fighters. Trees targeted for removal would primarily be the small understory conifer trees that serve as surface and ladder fuels to adjacent overstory trees. Some mid- and upper-story trees may be removed to break up canopy fuel continuity. The treatment will create lower crown densities initially, generally from 30 to 40 percent.

threshold of concern (TOC)

Each affected sub-watershed is given a threshold of concern value based on watershed sensitivity indicators (soils, slopes, unstable lands, beneficial uses at risk, etc.). The closer the calculated equivalent roaded acres value for the sub-watershed is to the threshold of concern, the higher the risk of adverse cumulative impacts to watershed and aquatic resources at the sub-watershed scale.

Wildland-urban Interface (WUI)

An area where human habitation is mixed with areas of flammable wildland vegetation. The WUI is an area of special consideration for wildland fire suppression due to the risk of lives and property. The WUI extends out from the edge of developed private land into Federal, private, and State jurisdictions. The WUI is the buffer in closest proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities. WUI zones generally extend roughly 1.5 miles out from these areas; however, actual WUIs are determined at by national, regional, and forest policy.

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