United States
Department of
Agriculture

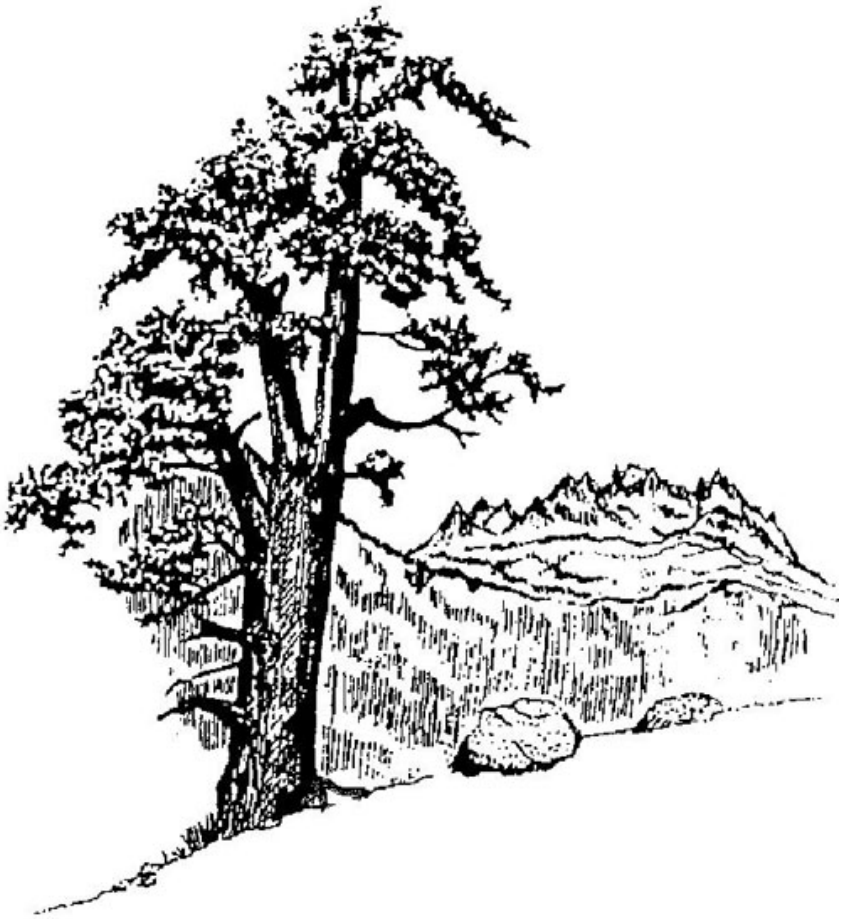
Forest
Service

**Pacific
Southwest**

Region

Draft Environmental Impact Statement for Sugar Pine Adaptive Management Project

**Sierra National Forest, Bass Lake Ranger District
Madera/Mariposa Counties, CA**



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SUGAR PINE ADAPTIVE MANAGEMENT PROJECT

Draft Environmental Impact Statement

Madera/Mariposa Counties, California; Sierra National Forest; Bass Lake Ranger District

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Abstract: This document examines the environmental effects of a proposal to move towards meeting management goals and objectives set forth in the Sierra National Forest Land and Resource Management Plan (as amended in January 2004). The purpose of the proposal is multi-faceted and has two primary purposes (1) to strategically place area treatments on the landscape to reduce the intensity and spread of wildfires across the landscape and near communities and (2) to reduce inter-tree competition to improve tree vigor whereby providing increased stand resistance to drought conditions, insect and disease attack. Alternatives considered in detail are: Alternative 1 (No Action), would leave the area in its present condition; Alternative 2 (Proposed Action), would thin conifer stands to reduce stand densities and ladder fuels; masticate ladder fuels and brush/shrub patches; utilize prescribed burning, understory and pile; manually treat and/or prescribed burn noxious weed infestations; and site prepare and plant failed conifer plantations; Alternative 3, would contain similar types of treatments as Alternative 2, but would limit the degree of treatment within known Pacific Fisher den site buffer to that needed to achieve fire and fuels objectives; and Alternative 4, would contain similar types of treatments as Alternative 2, but would limit the degree of treatment to that needed to achieve fire and fuels objectives in all treatment areas.

Public Comments: Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3). The opportunity to comment ends 45 days following publication of the notice of availability (NOA) in the Federal Register.

Send Comments to: Edward Cole, Forest Supervisor; Sierra National Forest, 1600 Tollhouse Road, Clovis, CA 93611; FAX: (559)294-4809; Electronic mail: comments-pacificsouthwest-sierra@fs.fed.us. Office hours are Monday-Friday 8:00am to 4:30pm.

The acceptable format(s) for electronic comments is: Rich Text Format (.rtf), MS Word (.doc) or pdf.

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Summary

The Sierra National Forest, Bass Lake Ranger District proposes to create a network of strategically placed landscape area treatments (SPLATs) and defensible fuels profiles near key transportation corridors to reduce the intensity and spread of wildfires across the landscape and near communities. As part of the proposal, further treatments to improve forest health within and outside of the SPLATs are proposed to reduce inter-tree competition and improve tree vigor to provide an increased stand resistance to drought conditions, insect and disease attack.

The area affected by the proposal includes 5,416 total project boundary acres within two watersheds, Fresno River and Big Creek, in the Southern Sierra Nevada. The project is centered on the community of Sugar Pine (designated as Wildland Urban Intermix [WUI]), immediately east of State Highway 41. Vegetation types include ponderosa pine, mixed conifer, hardwood species, as well as areas dominated by brush, rock and steep slopes.

This action is needed, because under the amended Sierra National Forest Land and Resource Management Plan (Sierra Nevada Forest Plan Amendment [SNFPA], Record of Decision [ROD], USDA-FS 2004), an ecosystem approach to project development and planning was recommended. In July 2005, the Bass Lake Ranger District completed the Fresno River Landscape Analysis. This document measured the desired condition for key ecosystem elements against the landscape's current condition. Where there was a significant departure from the desired condition or potential for a loss in key ecosystem functions, opportunities for management actions to address this departure were developed. An emphasis on the inter-relationship of the major functional program goals was placed on these opportunities. Within this landscape analysis, of particular concern was the State Highway 41 Corridor with its high concentration of human habitation and activities, the Nelder Grove Historical Area of Giant Sequoias and the declining health of forest stands within and surrounding these areas.

The community of Sugar Pine is one of the communities of interest within the State Highway 41 Corridor and is considered highly vulnerable to and at risk from wildland fire. Current forest conditions, due to past management activities (including harvesting operations, fire exclusion/suppression, housing development, etc.) have been changed from one where fires were of frequent, low intensity to infrequent, moderate/high intensity. Forest structure and composition has developed, through the lack of fire in a fire dependent ecosystem, into an overabundance of shade-tolerate conifer species in the lower and mid-level canopies of the forested stands. Other areas converted from forested stands to brush species. This overstocking of conifers has led to a decline in forest health and high susceptibility of loss from insects, disease, drought conditions and wildland fire.

A variety of wildlife species are highly dependent on conditions provided by functioning ecosystems (Pacific fisher, California spotted owl and Northern goshawk, to name a few) and are susceptible to possible loss of viability if the degree of change in their habitat and the ecosystem in which they are dependent on is improperly balanced. There is uncertainty (due to gaps in information) surrounding what is the proper balance of change that can occur in these species habitat, where forest functionality and vulnerability can be improved and where human habitation's susceptibility to wildland fire can be reduced.

These issues led the agency to develop alternatives to the proposed action including:

- **Alternative 1 – No Action**. Under the No Action alternative, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences.

- **Alternative 2 – Proposed Action**. Under Alternative 2, the development of Strategically Placed Area Treatments (SPLATs) would occur. Additional areas would be treated to provide a defensible fuels profile near key transportation corridors and within the defense zone of the wildland urban intermix. In addition to those treatments needed to meet fire and fuels objectives, treatments would be created to reduce stand densities (basal area) to such a level as to improve the growth and vigor of remaining trees. Treatments included in this alternative are: thinning from below in conifer stands, either by pre-commercially, commercially, biomassing and/or mastication of vegetation (conifers) to reduce lower and mid- level canopy stand densities; mastication of brush and shrub patches; prescribed burning, both understory and piles; manual reduction and/or prescribed burning of noxious weed infestations; and prepare and plant failed conifer plantations.
- **Alternative 3 – Lower and Limited Mid-level Canopy Treatments within Known Den Site Buffer**. Under Alternative 3, all treatment areas would be carried forward from Alternative 2, but in areas where there are known Pacific Fisher den sites, treatments within associated den site buffer would include only those treatments needed to achieve fire and fuels objectives (treatment of surface and ladder fuels). All other treatment areas would continue to treat for both fire/fuels and forest health (stand density) objectives.
- **Alternative 4 – Lower and Limited Mid-level Canopy Treatments, All Treatment Areas.** Under Alternative 4, all treatment areas would be carried forward from Alternative 2, but treatments would include only those needed to achieve fire and fuels objectives (treatment of surface and ladder fuels).

Major conclusions are demonstrated in the following table:

Table S-1. Major Conclusions

Resource Area	Indicator	Alt 1	Alt 2	Alt 3	Alt 4
Cultural Resources (page 28)	Degree to which historic property values are diminished	18 sites that have the potential to be affected Direct/Indirect Adverse Effects could occur if a conflaguration was to occur especially to wooden components of sites. Cumuluative effects are unlikely.	18 sites that have the potential to be affected Through Sierran PA, All of these cultural resource sites and historic features will be protected through avoidance. By implementing the Standard Protection Measures outlined in the Sierran PA, no historic values would be diminished as a result of implementing this alternative.	18 sites that have the potential to be affected Through Sierran PA, All of these cultural resource sites and historic features will be protected through avoidance. By implementing the Standard Protection Measures outlined in the Sierran PA, no historic values would be diminished as a result of implementing this alternative.	18 sites that have the potential to be affected Through Sierran PA, All of these cultural resource sites and historic features will be protected through avoidance. By implementing the Standard Protection Measures outlined in the Sierran PA, no historic values would be diminished as a result of implementing this alternative.
Botanical TES (page 33) *Other plant species do not have habitat within the project area, therefore will not be impacted by any of the alternatives.	Determinations for TES species				
	No effect	1 Threaten species *Calyptridium pulchellum*	1 Threaten species *Calyptridium pulchellum*	1 Threaten species *Calyptridium pulchellum*	1 Threaten species *Calyptridium pulchellum*
	May affect but is not likely to adversely affect	N/A	N/A	N/A	N/A

Resource Area	Indicator	Alt 1	Alt 2	Alt 3	Alt 4
	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability	4 Sensitive species *Epilobium howellii* *Peltigera hydrothyria* *Hulsea brevifolia* *Cypripedium montanum*	4 Sensitive species *Epilobium howellii* *Peltigera hydrothyria* *Hulsea brevifolia* *Cypripedium montanum*	4 Sensitive species *Epilobium howellii* *Peltigera hydrothyria* *Hulsea brevifolia* *Cypripedium montanum*	4 Sensitive species *Epilobium howellii* *Peltigera hydrothyria* *Hulsea brevifolia* *Cypripedium montanum*
Noxious Weeds (page 33)	Potential for Noxious Weed Spread	Increased risk of spread if wildfire was to occur in the area and fireline equipment does not follow Noxious Weed Prevention Practices.	Low risk of spread through use of design criteria for prevention of spread.	Low risk of spread through use of design criteria for prevention of spread.	Low risk of spread through use of design criteria for prevention of spread.
Soils/Geology (page 39)	Potential for reduction in Soil porosity due to compaction	Compacted soils (in 6.71% of the project area) will continue to recover over time with no additional disturbance.	Design Measures will minimize detrimental compaction of soils.	Design Measures will minimize detrimental compaction of soils.	Design Measures will minimize detrimental compaction of soils.
	Soil Cover Remaining (Large Woody Debris)	Meets and/or exceeds current Regional Standards	Reduction, but will continue to meet and/or exceed Regional Standards	Reduction, but will continue to meet and/or exceed Regional Standards	Reduction, but will continue to meet and/or exceed Regional Standards
Lands/Special Uses (page 51)	Effects to Special Uses Permitted in Project Area.	No Effect	With implementation of Design Criteria minimal to No effect	With implementation of Design Criteria minimal to No effect	With implementation of Design Criteria minimal to No effect

Resource Area	Indicator	Alt 1	Alt 2	Alt 3	Alt 4
Terrestrial Wildlife TES (page 53) *Listed are species that do not have habitat withinor adacent to the project area, nor are directly, indirectly or cumulatively effected by this project therefore the project will have no effect on them: *Democerus californicus* *Hailealetus leucocephalus* *Gulo gulo* *Falco peregrinus* *Vulpes vulpes necator* *Empidonax trailli*	Determination for TES Species	(T)=Endangered (E)=Proposed (C)=Candidate (FSS)=FS Sensitive			
	No effect	Townsend's big-eared bat Western red bat	Townsend's big-eared bat Western red bat	Townsend's big-eared bat Western red bat	Townsend's big-eared bat Western red bat
	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability (S)	California spotted owl (CASPO), Northern Goshawk (NOGO), Great gray owl (GGO), American Marten (AMMA), Pacific Fisher (PAFI), Pallid bat (PABA)	CASPO, NOGO, GGO, AMMA, PAFI, PABA	CASPO, NOGO, GGO, AMMA, PAFI, PABA	CASPO, NOGO, GGO, AMMA, PAFI, PABA

Resource Area	Indicator	Alt 1	Alt 2	Alt 3	Alt 4
Aquatic Wildlife TES (page 63) *Listed are species that do not have habitat withinor adacent to the project area, nor are directly, indirectly or cumulatively effected by this project therefore the project will have no effect on them: *Central Valley Steelhead (T)* *Delta smelt (T)* *Hardhead (FSS)* *Limestone Salamander (FSS)* *Relictual slender salamander (FSS)*	No effect	California Red Legged Frog (T) Foothill Yellow-Legged Frog (FSS) Western Pond Turtle(FSS) Moutain Yellow Legged Frog (C/FSS) Yosemite Toad (C/FSS)	California Red Legged Frog (T) Yosemite Toad (C/FSS)	California Red Legged Frog (T) Yosemite Toad (C/FSS)	California Red Legged Frog (T) Yosemite Toad (C/FSS)
	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability	N/A	Foothill Yellow-Legged Frog (FSS) Western Pond Turtle(FSS) Moutain Yellow Legged Frog (C/FSS)	Foothill Yellow-Legged Frog (FSS) Western Pond Turtle(FSS) Moutain Yellow Legged Frog (C/FSS)	Foothill Yellow-Legged Frog (FSS) Western Pond Turtle(FSS) Moutain Yellow Legged Frog (C/FSS)
Aquatic Management Indicator Species (page 63)	Habitat conditions or alteration and their effects on species	Macro-inverttebrates and Pacific Tree Frog= No expected direct, indirect or cumulative effects	Macro-inverttebrates and Pacific Tree Frog= Project Design Criteria expected to eliminate or minimize effects	Macro-inverttebrates and Pacific Tree Frog= Project Design Criteria expected to eliminate or minimize effects	Macro-inverttebrates and Pacific Tree Frog= Project Design Criteria expected to eliminate or minimize effects

Resource Area	Indicator	Alt 1	Alt 2	Alt 3	Alt 4
Terrestrial Management Indicator Species (page 89)	Habitat conditions or alteration and their effects on species	Largest effect on some species habitat would be loss or alteration created by uncontrolled wildland fire.	Although there would be alterations to habitat, not any one particular habitat would be adversely affected or cause effects on species dependent on that habitat.	Although there would be alterations to habitat, not any one particular habitat would be adversely affected or cause effects on species dependent on that habitat.	Although there would be alterations to habitat, not any one particular habitat would be adversely affected or cause effects on species dependent on that habitat.
Hydrology (page 105)	Cumulative Watershed Effects (CWE's) Threshold Levels Reached	One watershed (Lewis-Red Rock 503.0055) is considered at or near CWE threshold prior to field investigation, showed little potential for CWE post investigation.	From field investigations and protections from Best Mgmt Practices, Stream Mgmt Zones and wildlife Design Criteria, CWE's not expected. See No Action for only at or near CWE consideration and result.	From field investigations and protections from Best Mgmt Practices, Stream Mgmt Zones and wildlife Design Criteria, CWE's not expected. See No Action for only at or near CWE consideration and result.	From field investigations and protections from Best Mgmt Practices, Stream Mgmt Zones and wildlife Design Criteria, CWE's not expected. See No Action for only at or near CWE consideration and result.
Air Quality (page 144)	Degree of degradation of Air Quality from Smoke	High degree of long lasting unhealthy to severe graded air quality from potential uncontrolled wildfire(s).	With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available.	With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available.	With prescribed burning occuring on Air District designated affirmative Burn Days, only short-term impacts to air quality would occur in isolated areas. Potential air quality impacts from wildfires would be reduced with less ground fuels available.

Resource Area	Indicator	Alt 1	Alt 2	Alt 3	Alt 4
Transportation System (page 149)	Effects of Transportation System	With minimal maintenance there is a continued potential for loss of infrastructure investment from erosion, wet weather use and brush encroachment.	Roads not meeting acceptable Standards will be required to be have maintenance, or recontruction done for project implementation. This can have the potential to reduce potential erosion problems caused by transportation corridors. 0.2 miles of new road will need to be built. 0.5 miles of temporary road will need to be built. Implementation of BMP and erosion control measures will reduce the impacts of such construction.	See Alternative 2.	See Alternative 2.

For a summary of Forest Vegetation/Silviculture and Fire/Fuels major conclusions please refer to Table 2, Comparison of Alternatives on page 19.

Chapter 1. Purpose of and Need for Action

Document Structure

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

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

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at Bass Lake Ranger District office in North Fork, California.

Background

The Sierra National Forest Land and Resource Management Plan (LRMP or Forest Plan) was amended in 2001 by the Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (USDA-FS 2001a, 2004). Standards and guidelines for forest project planning were to focus on the modification of fire behavior through fuels treatments. These treatments were to have the highest priority in areas described as Wildland Urban Interface/Intermix (WUI). In 2004, a Supplement was written to the SNFPA and a Record of Decision (ROD) was signed (USDA-FS 2004). This ROD replaced the 2001 decision in its entirety. This decision recommended an ecosystem approach whereby the development and planning of projects would be not only based on fuels reduction treatments, but would create an overall approach by looking at all key elements within an ecosystem. WUI continued to be the highest priority area for treatments. In July 2005, the Bass Lake Ranger District completed the Fresno River Landscape Analysis. In this Landscape Analysis, the State Highway 41 Corridor with its high concentration of human habitation and activities, the Nelder Grove Historical Area of Giant Sequoias and declining health of forest stands was placed as an area with greatest departure from desired conditions and where opportunity existed to move it closer to that desired condition. The Sugar Pine Adaptive Management Project is one of the State Highway 41 Corridor areas.

As part of the SNFPA ROD (USDA-FS 2004), an adaptive management and monitoring program designed to address high priority, key questions that relate to the uncertainties associated with management activities and their effects on wildlife habitat and modified wildfire behavior was to be initiated. In 2006, Region 5 (Pacific Southwest Region) of the Forest Service, as well as other Federal and State Agencies, entered into an agreement with the University of California whereby the university would act as a neutral third party to study the effects of management activities associated with the implementation of the SNFPA ROD (2004) in four key areas; wildlife (specifically Pacific fisher/California spotted owl), fire and forest health, water quality and quantity, and public participation. This adaptive management study is known as the Sierra Nevada Adaptive Management Project (SNAMP). The Sugar Pine Adaptive Management Project is one of two projects in the region where these key areas are to be studied.

This Environmental Impact Statement includes the need to amend the Sierra National Forest Land and Resource Management Plan, SNFPA ROD (2004) for Alternative 2 (Proposed Action) of this project. In the SNFPA ROD (USDA-FS 2004) Standards and Guidelines for Pacific Fisher Den Sites, #86 states…"If areas within den site buffers must be treated to achieve fuels objectives for the urban wildland intermix zone, limit treatments to mechanical clearing of fuels. Treat ladder and surface fuels to achieve fuels objectives." In 2008, three den sites were located within the project area where treatments are proposed to meet both fuels and forest health objectives. The ability to locate these den sites has been enhanced by the intensive tracking of Pacific fisher movement throughout the project area as part of the SNAMP Study. The rationale for the need to amend the SNFPA ROD (2004), specifically Standard and Guideline #86 is three-fold: 1) Den sites have been surveyed for and attempts made to locate these sites for past projects, with no success; 2) It is highly unlikely that surveys conducted for future projects will be able to locate den sites; 3) To measure the effects of management activities, as is being done through the SNAMP study, treatments would need to be implemented based on the type of information that would be available during normal project development and planning, which includes the low probability of locating fisher den sites. As such, in Alternative 2 treatments would be implemented, as proposed, meeting both fire/fuels and forest health objectives with the knowledge that treatments are within Pacific fisher habitat having the potential for use as denning sites. Information about den site locations will be utilized, for this alternative, only to develop a den site buffer whereby a Limited Operating Period from March 1 to June 30 will be implemented (S&G #85). The effects of such amendment are addressed in Chapter 3-Affected Environment and Environmental Consequences beginning on page 23.

Purpose and Need for Action

The underlying need(s) for this proposal include:

1. There is a need for fuel reduction (in the surface and ladder fuels) that protects human communities from moderate/high intensity wild fires as well as minimizes the spread of wildfires that might originate in urban areas into the forested lands. The reasons for this need are to increase the efficiency of firefighting efforts and reduce risks to firefighters, the public, facilities and structures, and natural resources from moderate/high intensity wild fires
2. There is a need for conifer stands to have improved resiliency to attack from insects, diseases, lower levels of yearly precipitation (drought conditions) and/or wildfire. The reasons for this need are conifer stands are well above what is considered normal stocking levels (stand densities) whereby creating a decline in growth, health and resiliency due to inter-tree competition for sunlight, nutrients and water, thus increasing a stands potential for higher rates of mortality.

In meeting the aforementioned needs the action must also achieve the following purposes:

1. A purpose of this proposal is to reduce the intensity and spread of wildfires across the landscape and near communities. The reason for this purpose is to provide a buffer between developed areas and wildlands where fire suppression capabilities are enhanced by modified fire behavior inside the WUI zones as well as provide a safe and effective area for fire suppression activities to occur (USDA-FS 2001, page 9).
2. A purpose of this proposal is to reduce stand density, within the lower and mid-canopy layers of conifer stands, to such a level as to provide for increased stand resiliency, growth and vigor. The reason for this purpose is to increase the capability for forested stands to withstand fluctuations in temperature and precipitation, attacks from insects and diseases, and from wildfires by creating sustainable stand densities.

Proposed Action

The action proposed by the Forest Service to meet the purpose and need is:

- Treat surface and ladder fuels (live and dead) to interrupt wildfire spread and fire intensity levels. This is proposed to be completed utilizing thinning and biomass thinning of pre-commercial and commercial conifers, mastication and/or dozer piling and burning in order to improve the ability of firefighters to suppress and control wildfires and provide a better measure of safety for the public and personnel.
- Commercially thin from below and biomass thinning mixed conifer, white fir and pine stands as well as pre-commercially thin young conifer plantations and conifer reproduction to reduce stand densities. This is being accomplished to improve the vigor of the stands.
- Masticate brush/shrub patches to tie treatment areas together in strategic locations.
- Utilize prescribed fire as a tool to reduce natural and activity-generated fuels through pile burning, under story and/or broadcast burning.
- Use prescribed fire and/or manual methods to treat infestations of noxious weeds, with the goal of eradication and preventing their spread into areas treated.
- Replant conifers within specific sites of failed conifer plantations.

The proposed action is described in more detail in Chapter 2 under Alternative 2, page 7.

Decision Framework

Given the purpose and need, the deciding official will review the proposed action, other alternatives, and their environmental consequences, in order to determine whether to implement the proposed action as described, select a different alternative or take no action at this time.

Forest Plan Direction

The Proposed Action and alternatives are guided by the Sierra National Forest Land and Resource Management Plan (LRMP), as amended by the Sierra Nevada Forest Plan Amendment Record of Decision, 2004 (USDA-FS 2004). The Sierra National Forest is subdivided into land allocations (management areas) with established desired conditions and associated management direction (standards and guidelines). Land allocations that apply to this proposal are shown on either

individual maps for specific land allocations or on the Land Allocations-Map 4, in the Map Package in Appendix A and include:

- **Wildland Urban Interface/Intermix (both Defense and Threat Zones)**. This land allocation encompasses 4,674 acres within the Sugar Pine Adaptive Management Project boundary. Of this acreage; 888 acres are designated as Defense Zone and 3,628 acres are designated as Threat Zone. There were no local site-specific adjustments made to these boundaries. There are Forest-wide standards and guidelines for this land allocation set forth in the SNFPA ROD (USDA-FS 2004). These forest-wide standards and guidelines were used to develop the purpose and need (USDA-FS 2004, pgs. 49-50).
- **Southern Sierra Fisher Conservation Area (SSFCA)**. This land allocation encompasses the entire Sugar Pine Adaptive Management Project area. The SNFPA ROD (2004) has set forth standards and guidelines for this land allocation that address protection measures for fisher den sites as well as direction for projects proposed in SSFCA (USDA-FS 2004, pgs. 61-62). In these standards and guidelines it is left to wildlife biologist to develop design criteria that protect important habitat structures within fisher habitat. These design criteria have been developed and are listed in Chapter 2, Design Criteria Common to All Alternatives starting on page 10.
- **California Spotted Owl Protected Activity Centers (PACs) and Home Range Core Areas (HRCA)**. This land allocation encompasses 4,700 acres of the project area as suitable nesting habitat and nearly the entire Sugar Pine Adaptive Management Project area is suitable foraging habitat. There are six PACs and associated HRCAs either entirely or partially within the project boundaries. The SNFPA ROD (2004) has set forth standards and guidelines for this land allocation that address mechanical treatments conducted to meet fuels management objectives in PACs located in the WUI defense zones and in threat zones where prescribed fire is not feasible and where avoiding PACs would significantly compromise the overall effectiveness of the landscape fire and fuels strategy (USDA-FS 2004, pgs. 59-61). These, as well as the remaining standards and guidelines for this land allocation are incorporated into design criteria and are listed in Chapter 2, Design Criteria Common to All Alternatives starting on page 10.
- **Northern Goshawk Protected Activity Centers (PAC)**. This land allocation encompasses 4,700 acres of suitable nesting habitat and nearly the entire Sugar Pine Adaptive Management Project area suitable foraging habitat. There are two PACs that either are entirely or partially within the project boundaries. The SNFPA ROD (2004) has set forth standards and guidelines for this land allocation which are similar to those for California spotted owl PACs (USDA-FS 2004, pgs. 59-61). The standards and guidelines for this allocation are incorporated into design criteria and are listed in Chapter 2, Design Criteria Common to All Alternatives starting on page 10.
- **Old Forest Emphasis Areas.** This land allocation is designated in approximately 2,870 acres within the Sugar Pine Adaptive Management Project boundary. Mature forest habitat is described by California Wildlife Habitat Relationship (CWHR) types 4M, 4D, 5M, 5D, and 6) where outside of the WUI defense zones standards and guidelines are designed to maintain and enhance the structures associated with these forest types and the protection of the species habitat associated with these forest ecosystems. As such, standards and guidelines associated with wildlife species that prefer mature forest habitat are used as the standards and guidelines for this land allocation. These are incorporated into design criteria and are listed in Chapter 2, Design Criteria Common to All Alternatives starting on page 10.

- **General Forest.** This land allocation is designated in approximately 742 acres within the Sugar Pine Adaptive Management Project boundary. The standards and guidelines associated with this land allocation are the same as those for Old Forest Emphasis Areas. As such, standards and guidelines associated with wildlife species that prefer mature forest habitat are used as the standards and guidelines for this land allocation. These are incorporated into design criteria and are listed in Chapter 2, Design Criteria Common to All Alternatives starting on page 10.
- **Riparian Conservation Areas**. This land allocation encompasses the entire Sugar Pine Adaptive Management Project area because of the extensive stream network acres within the project boundary. The standards and guidelines, specifically the Resources Conservation Objectives from the SNFPA ROD (USDA-FS 2004), associated with this land allocation are incorporated into design criteria and are listed in Chapter 2, Design Criteria Common to All Alternatives starting on page 10.

Public Involvement

A Notice of Intent (NOI) to prepare an Environmental Impact Statement for the Sugar Pine Adaptive Management Project was published in the Federal Register on October 12, 2007. The notice asked that comments on the proposed action be received by October 31, 2007. In addition, as part of the public involvement process, the Forest Service sent scoping letters to residents within 1.5 mile radius of the project area, to members and groups in the Native American community and to publics expressing interest in the project through scoping opened during the project posting in the Sierra National Forest Schedule of Proposed Action. These scoping letters were sent on August 31, 2007. On September 5, 2007, the Forest Service held a public meeting in Oakhurst, California, as well as a public field trip to the project area on September 29, 2007. Letters inviting interested publics were mailed to each individual that had been sent an initial scoping letter as well as electronically mailed to individuals participating in the Sierra Nevada Adaptive Management Project (SNAMP). A news release announcing the public meeting was sent to the Sierra Star (local newspaper) on September 3, 2007. The public meeting and public field trip were attended by approximately 30 individuals from the local community, local fire safe council, and environmental community. In addition to comments received during the public meeting and field trip, five comment letters on the proposed action were received.

As part of the public participation portion of the SNAMP study of this project, a group of stakeholders designated as the Integration Team, was formed. Throughout the planning process the Integration Team has held several open forums with the SNAMP team and the Forest Service, Bass Lake Ranger District Interdisciplinary Team to discuss project planning, modifications to the proposed action, updates on base information collection and potential effects based on most recent information collected by SNAMP. In conjunction with the written comments received during the scoping period and the issues associated within written comment (see below), recommendations and items of concern at these meetings have been brought forward into this analysis and led to the development of Alternatives 3 and 4 and are discussed in detail in Chapter 2 starting on page 8.

Issues

Comments from the public and other agencies were used to formulate issues concerning the proposed action. There were no comments received from members or groups from the Native American community. The Forest Service separated the issues into two groups: significant and

non-significant. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…". A list of non-significant issues and reasons why they were found non-significant may be found in the project record located at Bass Lake Ranger District Office in North Fork, CA.

The Forest Service identified the following significant issue during scoping:

Issue: The issue is the proper balance between where forest functionality and susceptibility can be improved and human habitations (WUI) susceptibility to wildland fire can be reduced while retaining important species habitat elements. Specifically, retention of important habitat elements for Pacific fisher, California spotted owl, Northern goshawk and Management Indicator Species as measured by:

- High canopy cover (average in a stand should not drop below 50% and significant portions of the treated stands should be at 60% or greater canopy cover),
- Especially in larger [>20 inch diameter] sized trees,
- Relatively high basal areas,
- Understory structure (provide for understory diversity),
- Adequate large snags and downed wood, and
- Available movement corridors linking to suitable habitat outside of project area (habitat connectivity).

These indicators are first addressed in design criteria common to all alternatives. The design criteria include standards and guidelines directly from the LRMP, SNFPA ROD (USDA-FS 2001a, 2004) and additional criteria developed to address the indicators above as well as those developed to minimize the potential environmental impacts of management activities on any given resource. The design criteria that are specific to retention of important habitat elements, as those listed in this issue, and are incorporated into Chapter 2, Alternatives Including the Proposed Action, starting on page 7 with the environmental consequences of this issue addressed in Chapter 3, Affected Environment and Environmental Consequences starting on page 23.

Two alternatives to the Proposed Action (Alternatives 3 and 4) were developed to address this issue and the indicators listed. The description of the alternatives can be found in Chapter 2, Alternatives Including the Proposed Action, starting on page 7 which includes how each addresses these indicators. These indicators are used as a means by which to compare the alternatives. The environmental consequences of changes in the level of treatments are addressed in Chapter 3, Affected Environment and Environmental Consequences starting on page 23.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the Sugar Pine Adaptive Management Project. It describes both alternatives considered in detail and those eliminated from detailed study. The end of this chapter presents the alternatives in tabular format so that the alternatives and their environmental impacts can be readily compared.

Alternatives Considered in Detail

Based on the issue identified through public comment on the proposed action and comments received through the SNAMP Integration Team collaboration, two additional action alternatives were considered in detail. In addition, the Forest Service is required to analyze a No Action alternative. These alternatives including the proposed action and no action alternative are described in detail below.

Alternative 1 – No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. No thinning, either commercial, pre-commercial and/or biomass operations, of mixed conifer and pine stands, mastication of brush/shrub patches, prescribed burning to reduce natural fuel accumulations and/or treatment of infestations of noxious weeds and replanting of conifers in failed conifer plantations would be implemented to accomplish the purpose and need.

Alternative 2 – The Proposed Action

Treatment areas within the project area boundary were delineated to include those areas where some form of treatment was necessary to meet the purpose and need. First treatment areas were designed to create SPLATs to reduce the intensity and spread of wildfires in and around WUI. Treatment areas near key transportation corridors (for egress and ingress into the community) and within the defense zone of the WUI were designed next. These treatment areas are designed to not only focus on those treatments needed to meet fire and fuel objectives (lower and limited mid-level canopy treatments), but the forested stands within the project area that are also considered overstocked with conifers (basal area and stand densities that are greater than can be sustained with changing environmental conditions). Treatment areas were further designed to address these areas. A treatment area map, Map 1, displays these treatment areas and can be found in the Map Package in the Appendix. Of the 5,416 total acres within the project boundary, approximately 2,920 acres were analyzed as areas where some form(s) of treatment are proposed (so named as treatment areas). The remaining 2,496 acres have no treatments proposed due to slopes greater than 35 percent, standards and guidelines limitation on treatment and/or no treatment is needed to meet the purpose and need.

In Alternative 2 (Proposed Action) the treatments would include:

- Commercial and biomass thinning an estimated 850 acres of approximately 90-110 year old natural conifer stands (within T areas);
- Commercial and biomass thinning an estimated 65 acres of approximately 45 year old ponderosa pine plantations (within T areas);

- Biomass thin an estimated 150 acres of approximately 70-90 year old natural 4 to 10 inch dbh (diameter at breast height) conifer stands (within T areas);
- Pre-commercial hand thin and remove fuel ladders, hand pile and burn on approximately 17 acres (within T 5 and M2);
- Pre-commercial thin, tractor pile and burn approximately 30 acres of natural conifer stands (within T areas);
- Masticate brush fields and masticate pre-commercial thin reproduction areas on approximately 245 acres (within T areas);
- Masticate brush fields, masticate fuel ladders, and masticate pre-commercially thin reproduction areas on approximately 395 acres (M areas);
- Perform fuelbreak maintenance on approximately 40 acres (M4);
- Pre-commercial thin/release plantations on approximately 115 acres (M10 (part), M11, 16, 24, and 25, portions of T6, 7, and 35);
- Plant and hand release site prepared openings on approximately 40 acres;
- Prescribed understory burn, as a primary fuels treatment, approximately 215 acres;
- Maintenance on approximately 28.2 miles of NFTS road;
- Reconstruction on approximately 9.8 miles of NFTS road;
- Construct approximately 0.5 miles of temporary road;
- Construct approximately 0.2 miles of new system road;
- Prescribed burn and/or manually treat infestations of noxious weeds, where located within the project treatment areas, with the goal of eradication and prevention of their spread.

Though a total of 2,920 acres are analyzed for treatments listed above, design criteria and standards and guidelines from SNFPA ROD (USDA-FS 2004) dictate areas where treatment can not occur to reduce and/or eliminate adverse effects on particular resources. These can include, but are not limited to heritage resources, botanical species, wildlife habitat, aquatic species and/or slopes greater than 35 percent. It is estimated that excluding these control areas from the treatment areas, a total of 1,908 acres will remain for treatment as proposed.

Alternative 3 – Lower and Limited Mid-Level Canopy Treatments within Known Den Site Buffer

In Alternative 3, treatment areas and the types of treatments would remain the same for all areas, as in Alternative 2, except for those portions of treatment areas T-4 and T-3 that are designated within the 700-acre Pacific Fisher den site buffer (as established by SNFPA ROD 2004, S&G #85 and #86) for known den sites. Treatments would be altered within the den site buffer to treat the lower and limited mid-level canopy (surface and ladder fuels) to address fire and fuels objectives within WUI (see Map 2, Map Package in Appendix A). There would be no additional treatment of the mid-level canopy (stand density) within the den site buffer. All other treatment areas would continue to have treatments similar to those listed in Alternative 2, which includes treatment of lower and middle level canopies. This alternative is being analyzed in detail to measure the effects as they relate to the implementation of the SNFPA ROD (2004) Standards and Guidelines

and is in response to the issue listed on page 6. There would continue to be approximately 2,920 acres treated under Alternative 3. In Alternative 3 the treatments would include:

- Commercial and biomass thin an estimated 760 acres of approximately 90-110 year old natural conifer stands (within T areas, except T4);
- Commercial and biomass thin an estimated 65 acres of approximately 45 year old ponderosa pine plantations (within T areas);
- Biomass thin an estimated 240 acres of approximately 70-90 year old natural 4 to 10 inch dbh conifer stands (within T areas);
- Pre-commercial hand thin and remove fuel ladders, hand pile and burn on approximately 17 acres (within T 5 and M2);
- Pre-commercial thin, tractor pile and burn approximately 30 acres of natural conifer stands (within T areas);
- Masticate brush fields and masticate pre-commercial thin reproduction areas on approximately 245 acres (within T areas);
- Masticate brush fields, masticate fuel ladders, and masticate pre-commercially thin reproduction areas on approximately 395 acres (M areas);
- Perform fuelbreak maintenance on approximately 40 acres (M4);
- Pre-commercial thin/release plantations on approximately 115 acres (M10 (part), M11, 16, 24, and 25, portions of T6, 7, and 35);
- Plant and hand release site prepared openings on approximately 40 acres;
- Prescribed understory burn, as a primary fuels treatment, approximately 215 acres;
- Maintenance on approximately 28.2 miles of NFTS road;
- Reconstruction on approximately 9.8 miles of NFTS road;
- Construct approximately 0.5 miles of temporary road;
- Construct approximately 0.2 miles of new system road; and
- Prescribe burn and/or manually treat infestations of noxious weeds, where located within the project treatment areas, with the goal of eradication and prevention of their spread.

Alternative 4 – Lower and Limited Mid-Level Canopy Treatments, All Treatment Areas

In Alternative 4, treatment areas would remain the same as in Alternative 2, but the treatments within these areas would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) needed to achieve fire and fuels objectives. Under Alternative 4 there would be no additional treatments (i.e. additional thinning in the mid-level canopy) to fully address stand density and forest health objectives.

This alternative would, in effect, assume the entire project area as a Pacific Fisher den site, whereby, it would be treated to achieve fire and fuels objectives for the urban wildland intermix zone and limit treatments to mechanical clearing of ladder and surface fuels. As such, all design criteria and SNFPA ROD (2004) standards and guidelines associated with Pacific Fisher den sites would be implemented with this alternative.

This alternative is brought forward for detailed study based on current information provided from SNAMP study of the detection and movement of Pacific fisher within the project area, Conservation Biology Institute (CBI) modeling and the document entitled "Baseline Evaluation of Fisher Habitat and Population Status and Effects of Fires and Fuels Management on Fishers In the Southern Sierra Nevada" (Spencer 2008).

This alternative was developed to address the issue listed on page 6. As well, this alternative is being analyzed in detail to measure the effects as they relate to focusing treatments on fire and fuels objectives without additional treatment for forest health (stand density). There would be approximately 2,920 acres treated under Alternative 4. In Alternative 4 the treatments would include:

- Biomass thin (fuel ladder reduction) an estimated 1,065 acres of approximately 70-90 year old natural conifer stands (within T areas);
- Pre-commercially hand thin and remove fuel ladders, hand pile and burn on approximately 17 acres (within T 5 and M2, see map);
- Pre-commercially thin, tractor pile and burn approximately 30 acres of natural conifer stands (within T areas, see map);
- Masticate brush fields and masticate pre-commercial thin reproduction areas on approximately 245 acres (within T areas, see map);
- Masticate brush fields, masticate fuel ladders, and masticate pre-commercially thin reproduction areas on approximately 395 acres (M areas, see map);
- Perform fuelbreak maintenance on approximately 40 acres (M4, see map);
- Pre-commercially thin/release plantations on approximately 115 acres (M10 (part), M11, 16, 24, and 25, portions of T6, 7, and 35, see map);
- Plant and hand release site prepared openings on approximately 40 acres;
- Prescribed understory burn, as a primary fuels treatment, approximately 215 acres;
- Maintenance on approximately 28.2 miles of NFTS road;
- Reconstruction on approximately 9.8 miles of NFTS road;
- Construct approximately 0.5 miles of temporary road;
- Construct approximately 0.2 miles of new system road;
- Prescribe burn and/or manually treat infestations of noxious weeds, where located within the project treatment areas, with the goal of eradication and prevention of their spread.

Design Criteria Common to All Action Alternatives

The Forest Service has developed the following design criteria to be used for all action alternatives. These are listed by resource area and are intended to minimize potential environmental impacts of the activities listed for each alternative.

Cultural Resources

Procedures and standard protection measures from the *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 Identification, Evaluation*

and Treatment of Historic Properties Managed by the National Forests of the Sierra Nevada, California (the Sierran PA) will be utilized for the protection of Heritage Resources within the project area. The primary protection measure will be avoidance, but additional measures, such as directional felling and monitoring can be used to minimize potential effects.

Botany

Project design criteria for protection of Forest Service sensitive plants:

a. All known lady's slipper orchid populations will be flagged for avoidance unless they occur in streamside management zones where no management activities will occur.

b. Populations of short-leafed hulsea that occur along Forest Roads 5S22Y and 5S06 will be flagged for avoidance prior to project implementation.

Project design criteria for prevention of spread of noxious weeds:

a. All heavy equipment used for implementing the project will be washed before arriving on site to remove soil and seeds of noxious weeds so that they are not transported into the project area.

b. Infestations of foxglove, klamathweed, oxeye daisy, broom, and bull thistle will be removed prior to project implementation, and a buffer zone will be flagged for avoidance to prevent heavy equipment from transporting seeds in the soil to other areas within the project boundary and beyond.

c. Any plantings or straw used for erosion control will be approved by the Forest Botanist to minimize the likelihood of accidental introduction of noxious weeds and to ensure compliance with the FS Pacific Southwest Region Native Plant Policy.

Geology/Soils

1. Leave a 100-foot wide buffer of 100 percent soil cover below large rock outcrops. These areas have a high potential to generate runoff that can cause accelerated erosion on soils down slope.
2. Conduct mechanical equipment operations (mechanical thinning and biomass removal equipment, log skidders and tractor-piling operations) when the soil is sufficiently dry in the top 12 inches to prevent unacceptable loss of soil porosity (soil compaction). Field checking by a soil scientist would be done to determine if operations could continue under **moist** soil conditions. "Maintain 90% of the soil porosity over 85% of an activity area (stand) found under natural conditions."
3. Subsoil and water bar skid roads and trails in areas where soil compaction exceeds 15% of a treatment area.
4. Limit mechanical operations, where sustained slopes exceed 35%, except where supported by on-the-ground interdisciplinary team evaluation.
5. Maintain 50% soil cover over all treatment areas. Where shrub species predominate, attempt crushing before piling to create small woody fragments left scattered over the site for soil cover and erosion protection.
6. Maintain at least five well-distributed logs per acre as large woody debris (LWD) representing the range of decomposition classes defined in the Regional Soil Quality Standards and Guidelines (S&G).

7. Provide for road surface stabilization (gravel) on roads over 5% that are located on sensitive soils, including Holland and Musick soils (LRMP S&G #129) and are affecting soil productivity and/or water quality.

Lands/Special Uses

There are numerous land type special uses authorized under permit in the project area including water systems (spring developments, water lines and storage tanks), buried fiber optic and telephone lines, a telephone carrier site near Sugar Pine, the Madera Irrigation District gauging station, overhead and buried electrical lines, roads, and apiary sites.

a. To provide a measure of protection, permit holders will be responsible for identifying the location(s) of their authorized improvements and/or right-of-ways so they are clearly visible during project implementation. Holders shall identify their improvements by using a combination of flagging and surveyors stakes; holders shall print their name and contact phone numbers on the flagging/stakes with indelible ink that is capable of lasting several years.

b. Roads authorized under permit that are damaged by project activities will be repaired by the operator(s) to pre-project condition.

c. The Madera Irrigation District Ditch is located in Treatment Areas T15 and M5 where mastication would occur. The Ditch has been in use for over 150 years, and a riparian vegetation type has developed along the banks of the ditch. There should be a minimum setback of 25 feet on either side of the ditch where the use of mechanical equipment should be restricted, or project activities are limited to the hand removal of brush. All slash that enters the ditch resulting from project activities will be removed by the end of the days operating period by the operator to prevent blockage of the ditch.

Recreation special uses authorized under permit in the project area include the Yosemite Mountain Sugar Pine Railroad (YMSRR) and Yosemite Trails Pack Station (YTPS). The YMSRR improvements located within their permit area including the railroad right-of-way, office, parking areas, amphitheater, bathroom, seating areas, etc. They are easily identifiable and should be avoided during project activities. The YMSRR operates the railroad 6 months a year between March and October; however, their peak visitor season is between June and mid-August. Project activities would occur adjacent to and within the permit area.

a. During project implementation various contractors and/or operators may need to cross the railroad tracks to gain access to treatment units. The Bass Lake Ranger District will identify the locations where rail crossings need to occur; and will work with the owner of YMSRR to design and construct the crossings to ensure heavy equipment does not damage the rail system during project implementation.

b. The district will work with the owner of YMSRR to minimize interruptions to YMSRR operations during Project implementation.

c. Contractors and/or operators will provide advance notification to the YMSRR when Project activities occur adjacent to the right-of-way and/or permit area, and advise the YMSRR when Project activities may result in a delay of YMSRR operations.

d. Contractors and/or operators will remove all activity slash generated from project activities that land on the railroad tracks and/or within the railroad right-of-way. The contractor and/or operator will provide a spotter, whose responsibility is to remove slash

from the tracks and right-of-way concurrent with the operation, or as soon as project activities cease, and the right-of-way is safe to enter.

The YTPS offers horseback rides three seasons of the year from their pack station headquarters adjacent to Big Sandy road, and offers horse driven sleigh rides from a secondary location south of Tenaya Lodge during winter months when snow conditions are favorable. The YTPS is authorized to use and maintain many of the horseback riding trails they take their clients on.

Trails used by YTPS and the Lewis Creek Recreation Trail may need to be crossed with equipment by operators to gain access to units. These trails are identified in the project folder and on the map entitled "Special Uses" within the Sugar Pine Project.

a. All project-related equipment will cross at locations perpendicular to identified recreation trails.

b. All slash will be pulled out of and away from trails. Activity fuels and slash will not be piled or treated within 5 feet of those trails.

Wildlife – Terrestrial

1. **Limited Operating Periods (LOPs)**: Should surveys locate activity centers or active nests for California spotted owls or Northern goshawks, LOPs will be applied within a ¼ mile radius of the activity center or nest. Should a great gray owl nest be located, nesting location will be protected by an LOP. LOPs will also apply to nests discovered during project implementation in un-surveyed areas. The district biologist will be notified when a nest or den of any TES or sensitive species is discovered within or adjacent to a treatment area.

2. **Snags and Down Woody Material** (USDA-FS 2004, Pg. 51-52):

   Down Woody Material: "Determine down woody material retention levels on an individual project basis, based on desired conditions. Emphasize retention of wood in the largest size classes and in decay classes 1, 2, and 3. Consider the effects of follow-up prescribed fire in achieving desired down woody material retention levels." Typically 10 to 20 tons of down woody material per acre is acceptable from a fuel loading standpoint, and will retain sufficient material to provide for post-treatment habitat for down woody utilizing species, based on extrapolation of pre-European stand conditions.

   Snag Retention: "Design projects to implement and sustain a generally continuous supply of snags and live decadent trees suitable for cavity nesting wildlife across a landscape. Retain some mid- and large-diameter live trees that are currently in decline, have substantial wood defect, or that have desirable characteristics (teakettle branches, large diameter broken top, large cavities in the bole) to serve as future replacement snags and to provide nesting structure. When determining snag retention levels and locations, consider land allocation, desired condition, landscape position, potential prescribed burning and fire suppression line locations, and site conditions (such as riparian areas and ridge tops) avoiding uniformity across large areas.

   The general guidelines for large-snag retention are as follows:

   Westside mixed conifer and ponderosa pine types – four of the largest snags per acre.

   Use snags larger than 15 inches dbh to meet this guideline. Snags should be clumped and distributed irregularly across the treatment units. Consider leaving fewer snags strategically located in treatment areas within the WUI. When some snags are expected to be lost due to hazard removal or the effects of prescribed fire, consider

these potential losses during project planning to achieve desired snag retention levels."

Since the Sugar Pine project area is all within the WUI, where possible, snags and wildlife leave trees will be retained in untreated areas (such as riparian management zones), and clumped in areas not in proximity to structures, access routes, fuel breaks, or private property.

3. **Protected Activity Centers (PACs) and Home Range Core Area (HRCA) treatments**: Where treatments will occur within PACs aim to maintain >70% canopy closure where available. Where treatments will occur within HRCAs aim to maintain >60% canopy closure where available.

4. **Pacific Fisher Habitat**:

   A 700-acre den site buffer of the best available habitat will be designated for known den site locations with a Limited Operating Period established within the den site buffer. If a new den site (s) should be located during implementation, a 700-acre den site buffer of the best available habitat will be designated and a Limited Operating Period established for that buffer area.

   From the "Sierra NF Interim Pacific Fisher Habitat Maintenance and Improvement Approach" (see Appendix C) the following design criteria will be applied to all action alternatives to address portions of the issue listed on page 6.

   - Maintain highest canopy cover possible to meet the prescription within stands, aim for 50-60% immediately post-harvest.
   - Thinning will not remove any trees larger than 30-inch dbh.
   - Retain groups of larger trees (greater than 20-inch dbh) at the rate of approximately one group per 2.5 to 3.5 acres. Ideally these groups would contain "defect" trees, those that have cavity and platform creating defects (mistletoe, rot, fork topped, broken limbs and tops) for den and rest sites.
   - Retain largest snags and logs. Do not remove snags unless it is safety concern (project does not propose to remove snags). Retain largest logs to maximum allowed by fuel loading standards.
   - Maintain habitat connectivity with Old Forest Linkages which consist of buffers of 300 feet on either side of perennial streams where canopy closure is retained at >60%, 150-foot buffers on either side of perennial streams where no trees >12-inch dbh are removed, and 50-foot buffers on either side of perennial streams where no fuels treatments will occur.

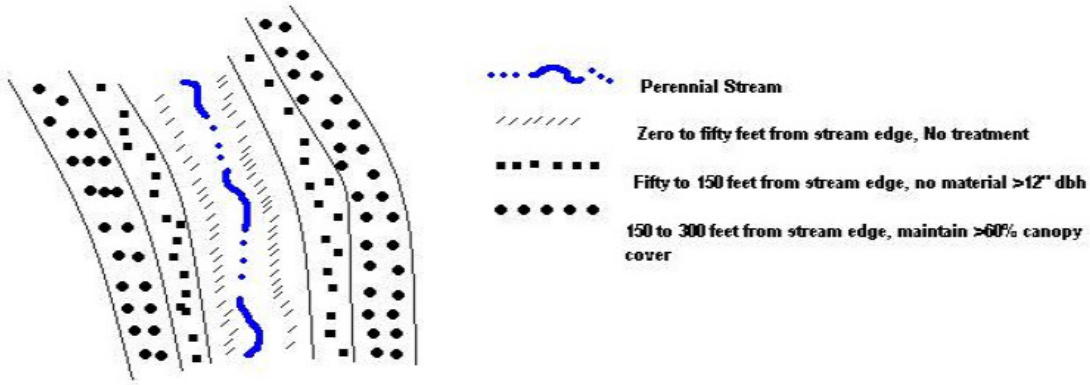

Figure 1. Associated Bounds and Treatments within Old Forest Linkages and Perennial Streams

It has been shown in the project area that black oaks tend to show cavities once they become 20 inches in diameter or greater. To maintain hiding cover for fisher and their prey, around black oaks >20-inch dbh create a buffer (35 feet from the bole or to dripline whichever is greater) where no fuels treatment will occur. This measure does not apply within fuelbreaks. This guideline is to be applied to two to three oaks per acre.

Prior to prescribed burning treatments, protect of important habitat structures such as large diameter snags and oaks, patches of dense large trees typically ¼ to 2 acres, large trees with cavities for denning/resting, well distributed clumps of small understory trees, and coarse woody material should be incorporated. For example, use firing patterns, place fire lines around snags and large logs, and implement other prescribed burning techniques to minimize effects to these attributes.

- Use mechanical treatments when appropriate to minimize effects on preferred fisher habitat elements.
- Remove unneeded roads in high quality fisher habitat.

Wildlife – Aquatics

Follow all applicable aquatic wildlife species and riparian habitat standards and guidelines from the 2004 Sierra Nevada Forest Plan Amendment, Final Supplemental Impact Statement and Record of Decision (USDA-FS 2004), the existing Sierra National Forest Land and Resource Management Plan direction (USDA-FS 1992), Forest Service handbook (FSH) 2509.22 Sierra Supplement #1 for treatments within Streamside Management Zones (SMZ, USDA 1989)), Best Management Practices and other applicable laws and regulations (USDA-FS 2000a). Generalized SMZ designation is outline in Table 1.

Table 1. Summary of Relationship between Feature Types, RCA Widths, Stream Classes, SMZ Widths, RMA Widths, and Stream Orders (and other GIS data)

Feature Type	RCA Width	Stream Class	SMZ Width	RMA Width	Corresponding GIS Layer Stream Order
Perennial Streams	300 feet	I	At least 100 ft	100 feet	4+
Seasonally Flowing Streams	150 feet	II	At least 75 ft	N/A	3
		III	At least 50 ft		2
		IV	At least 25 ft		1
		V	None required		-
Streams in Inner Gorge	Top of inner gorge	Varies			
Special Aquatic Features (fens, bogs, springs, seeps, lakes, ponds, wetlands, etc.)	300 feet	N/A	N/A	100 feet	Either identified on GIS layers (meadows, springs, lakes), or identified in the field

1. Class I SMZs are within or adjacent to treatment areas: T4, T5, T7, T8, T9, T10, T11, T13, T14, T15, T23, T24, T26, T32, T33, M2, M5, M6, M7, M8, M10, M9, M11, M12, M13, M16, M24, M25, Rx 1, Rx 3, and Rx 5. Old Forest Linkage Prescriptions apply to these SMZs. No treatments within inner 50 feet from stream bank.
2. Protect any Special Aquatic Features (seeps, springs, bogs, fens, and/or wet areas) that may be found during project implementation that are not already identified on project analysis maps. Treat these areas as perennial (Class I) areas with 300 foot Riparian Conservation Areas (RCAs). This includes treatment areas: T3, T4, T7, T26, T30, T32, T33, T34, M11, and M16.
3. In the outer 50 feet of Class I SMZs, reduce fuel loading by:
   a. Removing ladder fuels (suppressed and intermediate trees);
   b. Removing diseased trees that will fall away from riparian areas; and
   c. Hand-piling slash as necessary to reduce the effects of under-burning;
   d. Maintaining trees with broken tops for source of Larger Woody Debris (LWD) recruitment if they are leaning toward stream channel.
4. Apply SMZs as mapped in Project Hydrology report.
5. General aquatic species and riparian habitat protection measures within all Riparian Conservation Areas (RCAs) are to:
   a. Do not allow mechanical equipment within 100 feet of meadows or other special aquatic features. Includes treatment areas: T3, T4, T7, T26, T30, T32, T33, T34, M11, and M16.
   b. Do not allow mechanical equipment within SMZ.

c. To protect bank stability, do not cut streambank trees (trees with drip line extending to or over edge of streambank).

d. Do not cut any tree located within a channel.

e. For water drafting, use a screened intake device and pumps with low entry velocity to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats. A Hydrologist and Aquatic Biologist would approve water-drafting sites. See Best Management Practices (BMP) 2-21 in Table 2 for specific requirements.

f. Monitor potential project effects to streams and aquatic habitat using the Region 5 (R5) Stream-Condition Inventory protocols (Frazier et al. 2005).

g. When lighting piles, start burn from one end only to allow escape route for any species inhabiting piles.

h. No lighting into SMZs, but fire can creep into zone.

6. Report any discovery of amphibians or reptiles (e.g. frogs, toads, salamanders, and turtles) during project sale preparation and implementation to the district biologist immediately.

7. If newly listed or unknown occurrences of Federally listed threatened, endangered, proposed, candidate or Forest Service sensitive aquatic species are found within the affected project area during sale preparation and implementation, additional species protection measures may need to be imposed by the district fisheries and aquatic biologist.

Hydrology

Project specific Best Management Practices, listed in Appendix B of this document, will be implemented.

Silviculture

A limited operating period would be imposed in well stocked stands heavy to fir (over 50% fir) where operations could begin August 1st or later when the sap is not running (fir bark is much more easily dislodged when the sap is running than later in the year). The District Silviculturist will determine which stands require a LOP during the thinning layout phase.

Fuels

Utilization of prescribed fire and designation of areas where prescribed fire will be used need to take into consideration the following:

1. In treatment areas designated as mastication (M), prescribed fire should first be considered where it is too steep and /or rocky for the masticator to work effectively, oak dominates the stand and/or as a maintenance treatment in areas where brush re-growth has not been slowed and have not been planted with conifers.

2. In treatment areas designated as tractor (T), prescribed fire should first be considered where there are larger residual trees (of size less susceptible to fire damage) with light fuel loadings, areas not being thinned due to steepness, follow-up treatments have been completed or are not required, and/or areas where conifer reproduction is not being used for re-generation of openings.

3. Prescribed fire should be used during the late fall or early spring, to minimize effects to trees during active growing period and within Pacific fisher denning habitat areas.

Engineering

1. Maintain all NFS roads to standards established in the Forest Service Handbook 7709.58. Perform road maintenance, reconstruction and new road construction activities to support project access needs. Insure drainage structures are functional and stable to prevent potential resource damage and degradation of water quality (S&G #78, #79, #124, #206 and BMPs).
2. Perform a final field review of project roads to determine reconstruction needs prior to project activities. Where economically feasible, place aggregate on existing native surface roads located in areas with High and very High Soil Erosion Hazard ratings (S&G #129).
3. Close temporary roads required for unit access upon completion of use; remove all culverts, rip and ditch landings, construct waterbars, block the entrance with a log and dirt berm, and disguise the entrance with brush to discourage additional traffic.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the need for the proposal, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

Alternatives based on varying the upper diameter limit (currently 30-inch dbh) for mechanical thinning to ensure a 50 to 60% plus canopy cover is maintained and by which wildfire intensity and spread are reduced

The purpose and need for this project is not solely focused on the reduction of wildland fire intensity and spread into and out of WUI, but includes the need to maintain sustainable forested stands by reducing stand density. In considering this alternative, it was determined that it incorporated many of the same concerns for the proposed action as were made in the issue listed on page 6, in particular, the need to maintain high canopy cover. In bringing forward Alternatives 3 and 4 for detailed study, as well as design criteria incorporated to address the issue listed on page 6, the effects of varying stand density treatments as they relate to meeting the purpose and need for fire/fuels objectives and forest health objectives is addressed. It was determined that any alternative based on varying upper diameter limits for mechanical thinning would measure the same effects as these two alternatives and would be duplicative to other alternatives.

Comparison of Alternatives

This table provides a brief summary of the alternatives and their environmental impacts in comparative format.

Table 2. Comparison of Alternatives

Measure or Effect	Alternative 1 – No Action			Alternative 2 – Proposed Action			Alternative 3			Alternative 4		
Total Project Area =5,416 acres; Total Acres Analyzed in Treatment Areas = 2,920 Estimated Acres by Alternative to be Treated by Treatment Area Type:												
Tractor	0 Acres			1,356 Acres (Commercial Thin= 914 acres; biomass/mast/precommercial thin= 432 acres; hand thin=10 acres)			1,356 Acres (Commercial Thin = 824 acres; biomass/ mast/ precommercial thin = 522 acres; hand thin = 10 acres)			1,356 Acres (Commercial Thin= 66 acres in plantations; biomass/mast/precommercial thin= 1,280 acres; hand thin=10 acres)		
Mastication	0 Acres			532 acres			532 acres			532 acres		
Prescribed Fire	0 Acres			215 acres			215 acres			215 acres		
Miles of Road												
Maintenance	0			28.2			28.2			28.2		
Reconstruction	0			9.8			9.8			9.8		
Temporary	0			0.5			0.5			0.5		
New Road	0			0.2			0.2			0.2		
Fire/Fuels Objective Measures:												
Fuel Model (Resultant)	4	10	12	12	TU1	9	12	TU1	9	12	TU1	9
Predicted Rate of Spread (chains/hour)	92	10	16	11	8	6	11	8	6	11	8	6
Predicted Flame Length (feet)	23	10	16	8	3	3	8	3	3	8	3	3

Measure or Effect	Alternative 1 – No Action			Alternative 2 – Proposed Action			Alternative 3			Alternative 4		
Predicted Fireline Intensity (BTU/ft²)	5131	282	781	531	63	47	531	63	47	531	63	47
Predicted Crown Fire Potential (Yes/No; Type)	Y/ Crowning	Y/ Crowning	Y/ Crowning	Y/ Torching	N/ Surface	N/ Surface	Y/ Torching	N/ Surface	N/ Surface	Y/ Torching	N/ Surface	N/ Surface
Resistance to Control (High, Moderate, Low)	High	High	High	High	Low	Low	High	Low	Low	High	Low	Low
Forest Health Objective Measures (Desired Condition by Species: Pine= 135; White Fir= 240; Mixed Conifer= 210)												
Estimated Range of Basal Area Remaining (ft²/acre) for >5-inch dbh conifers	130 to 480 ft²/acre (all species)			130 to 330 ft²/acre (all species)			130 to 330 ft²/acre (all species) (Treatment area T4 would be changed from estimated range BA remaining of 130 to 190 to 130 to 310 with this Alternative)			130-480 ft²/acre (all species)		
Estimated Range of Stems per Acre Remaining for >5-inch dbh conifers (# trees/acre)	= 65 to 251 trees/acre (all species)			44 to 101 trees/acre			50-142 trees/acre (all species) (Treatment area T4 would be changed from estimated range Stems/Acre remaining of 57 to 84 to 66 to 142 trees/acre)			66 to 153 trees/acre (all species)		
Habitat Indicators (From Issue):												
Estimated Range of Average Canopy Cover Remaining (%)	39 to 100% Average= 69%			39 to 88%; Average= 57%			39 to 97%; Average= 58%			39 to 100%; Average= 69%		

Measure or Effect	Alternative 1 – No Action	Alternative 2 – Proposed Action	Alternative 3	Alternative 4
Estimated Average Tree Diameter Removed (inches at dbh)	N/A	11 to 20-inch dbh	11 to 20-inch dbh (Treatment Area 4 would be changed from 11 to 20-inch dbh to 5 to 10-inch dbh with this alternative)	5 to 10-inch dbh
Large Snag and Down Wood Standard for Treated Areas	N/A	Listed in Design Criteria Common to All Alternatives (pages 10-18)	Listed in Design Criteria Common to All Alternatives (pages 10-18)	Listed in Design Criteria Common to All Alternatives (pages 10-18)
Movement Corridors Addressed (Yes or No)	Yes, with assumption corridors are present currently	Yes, addressed as Old Forest Linkage Areas on page 14.	Yes, addressed as Old Forest Linkage Areas on page 14.	Yes, addressed as Old Forest Linkage Areas on page 14.

Chapter 3. Affected Environment and Environmental Consequences

This chapter describes aspects of the environment likely to be affected by the proposed action and alternatives. Also described are the environmental effects (direct, indirect, and cumulative) that would result from undertaking the proposed action or other alternatives. Together, these descriptions form the scientific and analytical basis for the comparison of effects in chapter 2.

Past, Present and Reasonably Foreseeable Actions

According the Council on Environmental Quality (CEQ) NEPA regulations, "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR 1508.7).

In order to understand the contributions of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because 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.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would nearly be impossible. Second, providing the details of past actions on an individual basis would not predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one can not reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions have. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past action, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EIS is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which states, in part:

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonably foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information

> regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision-making. (40 CFR 1508.7)"

In determining cumulative effects, the effects of the following past, present and future actions were added to the direct and indirect effects of the proposed action and alternatives.

Table 3. Past, Present and Reasonably Foreseeable Actions Contributing to Cumulative Effects by Resources Action is likely to Effect

Activity Type	Description	Year	Unit Of Measure	Air Quality	Aquatics	Botany/NW	Fuels/Fire	Fuels/CBD	Human Health	Heritage	Vegetation	Soil	Transportation	Watershed	Wildlife
Roads/Trails USFS, County, State owned and maintained	Includes the network of inventoried road/trail systems within project subwatersheds	On-going	86 miles	X	X	X				X		X	E	X	X
Campground and other USFS Owned Facilities	Big Sandy Campground, Little Sandy Campground, West Fall Campground, West Fall Fire Station	Existing	4 sites		X		X					X		X	X
Past/Current USFS Timber Sales within Sugar Pine subwatersheds	Includes: 1) Green Timber Sales 2) Salvage Harvest 3) Thinning	1) 1980s 2) 1990s 3) 2000-Current	1) 2,640 acres 2) 1,532 acres 3) 189 acres	X	X	X	X	X		X	X	X	X	X	X
Vegetation Management Plantation Maintenance	Clearcutting, thinning, hand release, chemical release, and planting in plantations <30 yrs old.	1980s	115 acres		X	X	X	X	X		X			X	X
Sugar Pine Railroad Yosemite Pack Station Infrastructure	Special Use Permits which include buildings, amphitheater, RR track, corrals, and trails.	Existing	Approx. 25 acres											X	X

Activity Type	Description	Year	Unit Of Measure	Air Quality	Aquatics	Botany/NW	Fuels/Fire	Fuels/CBD	Human Health	Heritage	Vegetation	Soil	Transportation	Watershed	Wildlife
Power Line	Power Line Corridor	Existing	Approx.4.5 miles				X								
Big Creek Ditch Diversion	Madera Irrigation Historical Ditch System	1850s	Approx.3 miles		X									X	
Roadside Hazard Tree Removal	Removal of damaged, rotten, dead trees to abate roadside hazard using timber sale contracts.	2003-present	41 miles	X	X	X/X	X			X	X	X	X	X	X
Fire/Fuels Management Activities	Includes Fuelbreak Construction and Maintenance, Prescribed Burning, ladder fuel removal, mastication	1980s-present	Approx. 600 acres	X	X	X	E	E	X	X	X	X		X	X
Private Land Infrastructure for communities of Sugar Pine, Cedar Valley and Fish Camp	New home construction, power, water, private roads	Ongoing	378 acres	X	X	X	X	X			X	X		X	X
Private Land-Vegetation Management in communities and other private lands	Timber harvesting, land type conversions Hazard fuels reduction	Ongoing	Individual Community Private Acres	X	X	X	X	X			X	X		X	X

Activity Type	Description	Year	Unit Of Measure	Air Quality	Aquatics	Botany/NW	Fuels/Fire	Fuels/CBD	Human Health	Heritage	Vegetation	Soil	Transportation	Watershed	Wildlife
Special Use Permitted Activities	Waterlines, Water storage tanks, fiber optic cable, apiary	Ongoing	Various Measures-Mapped Locations		X	X	X	X		X	X	X	X		X
Motorized Recreation	4X4, OHV, snowmobile uses of system and temporary roads	Ongoing	86 miles	X	X	X/X						X	X	X	X
Livestock Grazing	Soquel Allotment	Ongoing	Soquel Mdw Pasture		X	X/X	X			X		X		X	X
Fish Camp Project	Vegetation Mgmt Project	Project proposal being developed 2009-2010	2,000 to 3,000 acres		X	X	X	X		X	X	X	X	X	X

Cultural Resources

Affected Environment

All throughout the Sierra National Forest are the remnants of past cultures that illustrate the centuries-old relationships between people and the land. These cultural resources hold clues to past ecosystems and human adaptations to them, provide links between living communities and the unique prehistoric and historic land uses of the Sierra NF, and help transform a visit to the woods into an encounter with history. These cultural resources comprise an irreplaceable and non-renewable resource record of past human life and land use. This record is contained in properties with archaeological research value, and locations of cultural importance to local Native American groups.

Archaeological and Historic Values

Cultural resources are the buildings, sites, areas, architecture, and properties that bear evidence of human activity and use, and have scientific, historic, and cultural importance. The cultural resources are not distributed equally across this acreage, but clustered according to the natural resources that were being used (e.g. acorn groves, timber stands, water, mineral locations). With new discovery upon almost every new survey effort, there continue to be many undiscovered cultural resources in the Sierra National Forest (Sierra NF).

Physical remains of over 10,000 years of human history are found throughout the Sierra National Forest. Except for the last century and a half of written history, the only record of this long human use is the remains left by the original native people and their descendants. At the time of contact with Euro-Americans, in the late 1700s and early 1800s, the Fresno River was the boundary between the southern Sierra Miwok to the north and west, and the Chukchansi Yokuts to the south and east. The Western Mono occupied the area around what is now Bass Lake. The boundaries between the groups were ambiguous, with a lot of overlap in the area between the Miwok, Yokuts and Mono.

The processes of subsistence, the hunter-gatherer lifestyle, and the resulting indigenous land use are seen in the archaeological record with features common to the material culture of the native people of the Sierra Nevada (e.g. village sites, bedrock mortars, stone tool artifacts). Some of these sites have ethnographic documentation that indicates a fairly recent history of tribal use; in some cases, tribal use continues at sites that have an occupational history that spans thousands of years.

Historic-era cultural resources reflect particularly the cultural and economic products of the rapid pace of technological achievement in the last 150 years imposed on the terrain of the Sierra Nevada. These resources often reflect environmental changes resulting from industrial and technological advances in resource extraction, landscape use, and management. Sites include remnants of Forest Service administration, exploration and settlement, grazing/range management, mining, transportation, travel, tourism and recreation, and the forest products industry. Each of these themes has an array of associated sites and features. For example, features associated with railroad logging operations may be work camps, refuse dumps, railroad grades, trestles, and discarded equipment.

Native American Cultural Values

Federally recognized tribal governments associated with the Sierra NF, as elsewhere in the United States, have a special political and legal relationship with the U.S. Government. Recognized tribes are also beneficiaries of a trust relationship with the Federal government. Federal agencies, such as the Forest Service, consult with tribes as with other governments and are responsible for protecting tribal interests. The Forest Service also consults with non-recognized tribes.

There is a deep and abiding concern with many Indian people about what occurs in their aboriginal territory. The Sierra NF honors the traditional ties that many tribal communities and Indian people have to this portion of the Sierra Nevada. Access to and use of the Forest and other public lands is critical for many Indian people, as community identity and cultural survival are dependent on continued access to ceremonial and sacred places, cemeteries, traditional gathering areas, archaeological sites, and resources at a variety of locations on forest land. Certain plants, animals, and locations provide for many needs, including food, medicine, utilitarian type materials, and ceremonial items. Specific resources insure that significant cultural traditions, such as basket weaving, survive and continue. These areas contribute to the tribal communities' way of life, their identity, their traditional practices and cohesiveness.

Consultation with tribes, the local Native American communities, and other interested parties to identify other cultural values, including contemporary Native American interests, was initiated with a Public Scoping Letter that was sent on August 31, 2007, to members and groups in the Native American community in accordance with the Sierran PA, NHPA, and other laws and regulations. Consultation has consisted of meetings, letters, and presentations, and is documented in the project record.

In the area of potential effect, the results of thirty years of cultural resource surveys and investigations have identified 15 archaeological properties that are associated with themes of Sierra NF history. Most sites represent prehistoric life ways; other sites represent historic-era land uses. All of the cultural sites were monitored to determine their current condition and risk of adverse effects.

The Sierra NF manages those cultural resources which are eligible for listing on the NRHP. The Forest does not manage or protect ineligible properties in project activities, unless there is local interest in preservation. NRHP eligibility has not been determined for every archaeological property in the project area. Unevaluated sites are considered potentially eligible, and managed as if eligible. The Sierran PA allows for deferred NRHP evaluation if the property would not be affected by the project, usually through application of Standard Protection Measures.

Contemporary Native American interests can include traditional cultural properties (sites associated with cultural practices or beliefs that are rooted in history and important in maintaining cultural identity), and plant gathering sites for basket materials, medicines, and food resources. The Sierra NF manages such known sites as cultural resources under the provisions of the NHPA, but where the interests of native people are considered to achieve a mutually beneficial outcome during project implementation. The location of these sites is also kept administratively confidential. The Sierra NF will maintain appropriate access to sacred and ceremonial sites, and to tribal traditional use areas, and has consulted with affected tribes and tribal communities to address access to culturally important resources and areas in this project analysis.

Methodology for Analysis

Data Sources

Existing information from cultural resource records, historic archives, maps, and GIS spatial layers was reviewed to provide specific information about historic properties, or the likelihood that unidentified properties might exist in non-inventoried areas.

The majority of the project had been adequately surveyed for prior projects between 1979 and 1994. In 2007 and 2008, additional surveys were completed in previously unsurveyed areas. For areas that had never been surveyed, new survey was conducted using a combination of intensive (0 – 30 meter transects) and cursory (50+ meter transects) coverage. Intensive survey was done in clear and/or non-steep terrain. Cursory survey was done where terrain was very steep or had dense brush cover.

Information about the survey, location of historic properties, and the nature of past or current effects, is available for those cultural resources within the area of potential effect, as documented in the archaeological inventory reports for the proposed project (Veilleux/Popelish 2007 and 2008). These reports, which describe the location and composition of the archaeological sites, are kept administratively confidential under the provisions of the Archaeological Resource Protection Act of 1979, 36 CFR 296.

Spatial Analysis

The location of the historic property is the unit of spatial analysis when considering effects in action alternatives. For some historic properties (e.g., Traditional Cultural Property), the setting beyond the historic property's location must also be considered when determining whether an adverse effect will occur.

Effects Timeframes

- Short-term effects occur within one year.
- Long-term effects occur up to 20 years.
- Cumulative effects are analyzed at a 20-year interval.

Measurement Indicator and Rationale

When assessing direct, indirect, and cumulative effects, assessments are based on a historic property possessing at least one of the following NRHP values (36 CFR 60.4(a – d)) unless specific information already exists:

- Prehistoric archaeological site: Criterion D
- Historic archaeological sites: Criterion D
- Historic structures: Criterion C

An undertaking can have no effect, no adverse effect, or an adverse effect. An adverse effect to a historic property can occur when an undertaking directly or indirectly causes alterations in its character or use. An adverse effect on a historic property occurs when an undertaking alters its important characteristics and is measured by the degree to which it diminishes its **location, design, setting, materials, workmanship, feeling** or **association** (Integrity Measures) (36 CFR 800.5(a)(1)). These integrity measures can also be used to characterize the nature of any potential effects, whether they are direct, indirect or cumulative effects; and their severity. The degree to

which historic property values are diminished will be used to measure the direct, indirect and cumulative effects of the proposed undertaking.

When the nature and scope of a proposed undertaking is such that its effects can be reasonably predicted and appropriate measures can be undertaken to ensure that the values of cultural resources or historic properties are not affected in any way, than those cultural resources or historic properties may be managed in a manner which ensures that their values are preserved by using the Standard Protection Measures outlined in the Sierran PA.

Alternative 1 – No Action

Direct and Indirect Effects

Under this alternative, no fuels reduction land management activities would occur. Current management plans would continue to guide management of the project area.

Direct effects under this alternative could happen should a conflagration occur. The lack of fuel reduction management could result in higher intensity wildfires, thereby adversely affecting cultural resources, especially those with wooden components. Should a conflagration occur, indirect effects could occur as a result of increased access to and visibility of cultural resources, increasing the likelihood of artifact looting.

Cumulative Effects

Cumulative effects on cultural resources can be variable as past, current and future actions within the project area have occurred and may continue in the future (i.e. logging activities, road construction). Historic logging and road construction activities did not account for the presence of cultural resources. As no action would occur under this alternative, cumulative effects are unlikely.

Alternative 2 – Proposed Action

Direct and Indirect Effects

There are a total of fourteen cultural resource sites that have the potential to be affected by implementing this alternative. One of these sites is an historic railroad logging system that has thirteen features that have the potential to be affected. These features include: spur grades, a flume, and log chutes that retain intact earthworks; camps and trash dumps; and log chutes with sheave posts. All of these cultural resource sites and historic features will be protected through avoidance (Sierran PA, Attachment 7, Stipulation II.B).

In addition, four of the cultural resource sites have forest road or site conflicts on roads identified for reconstruction needs through the proposed action. With additional protection measures such as padding the site with gravel, staying within the existing road prism or no reconstruction within specified site areas, there will be no effect to these sites (Sierran PA, Attachment 7, Stipulation II.B).

By implementing the Standard Protection Measures outlined in the Sierran PA, no historic values would be diminished as a result of implementing this alternative. There will be no direct or indirect effects to cultural resources under Alternative 2.

Cumulative Effects

As all heritage resource sites will be avoided through project design from current project activities and predictable future project activities, it is anticipated there will be no cumulative effects from this action alternative.

Alternative 3

Direct and Indirect Effects

Effects would be the same as Alternative 2.

Cumulative Effects

Cumulative effects would be the same as Alternative 2.

Alternative 4

Direct and Indirect Effects

Effects would be the same as Alternative 2.

Cumulative Effects

Cumulative effects would be the same as Alternative 2.

Botany: Rare plants and Noxious Weeds

Affected Environment

Rare Plants

Three species of Forest Service sensitive plants occur in the Sugar Pine project area. Generally speaking, the project area is relatively homogeneous from the standpoint of rare plant habitat, being dominated by various phases of the mixed conifer forest type typical of the western slope of the Sierra Nevada. There are no meadows, fens, or significant areas of rock outcrop or open gravel habitats. The area is characterized by Sierran mixed conifer forest dominated by white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa),* incense cedar (*Calocedrus decurrens),* sugar pine (*Pinus lambertiana),* with black oak (*Quercus kelloggii)* as the major hardwood within the stands. Areas vary from drier sites with a solid understory of bear clover (*Chamabaetia foliolosa*) to more mesic sites with an understory of dogwood (*Cornus nuttallii)* and hazelnut (*Corylus cornuta).* Common shrubs are *Arctostaphylos viscida* var. *mariposa, A. patula, Chrysolepis sempervirens, Ceanothus integerrimus, C. diversifolius,* and *C. cordulatus.*

The threatened, endangered, or sensitive plants considered in this document are displayed in the following table.

Table 4. Threatened and Sensitive Plant Species Considered

Latin Name	Common Name	Status
Calyptridium pulchellum	mariposa annual pussypaws	Fed. Threatened
Cypripedium montanum	mountain lady's slipper orchid	FS Sensitive
Epilobium howellii	subalpine fireweed	FS Sensitive
Hulsea brevifolia	short-leafed hulsea	FS Sensitive
Peltigera hydrotheria	veined water lichen	FS Sensitive

The Sierra National Forest botanist checked the U.S. Fish and Wildlife Service web site for Federally-listed plants that may be found in the project area (USFWS 2009). The list contains two plant species and two categories of critical habitat that may occur within the Forest. *Sidalcea keckii* is only known from outside the Forest to the south, and if it were to occur in the Sierra National Forest, it would not be found north of the San Joaquin River at the elevations of the Sugar Pine Adaptive Management Project. It grows in clay soils (derived from serpentine) in sparsely-vegetated grasslands at elevations between 400 and 1,400 feet in the foothills of California's central western Sierra Nevada. The proposed critical habitat for *Sidalcea keckii* falls entirely outside the national forest boundary.

The proposed critical habitat for vernal pool plants does not fall within the Sugar Pine Adaptive Management Project area, and none of the Federally-listed vernal pool plants are known or expected to occur in the Sierra National Forest.

Calyptridium pulchellum (Mariposa annual pussypaws) is known to occur in the Sierra National Forest at elevations below 3600 feet, but there are no known occurrences of Mariposa pussypaws in or near the project area, and no suitable habitat exists. The elevation of the Sugar Pine Project is well above the upper elevation limit for the Mariposa pussypaws. No consultation is necessary with U.S. Fish and Wildlife Service, and no further analysis will occur.

Forest Service Sensitive Plant Species in the project area

Populations of mountain lady's slipper orchids, short-leafed hulsea, subalpine fireweed, and veined water lichen occur within the project area. No other Forest Service sensitive plants were found during surveys, and the following effects analysis will focus on these four species.

Subalpine fireweed – *Epilobium howellii*

Subalpine fireweed is known from meadows, riparian areas, and seeps at approximately 120 sites in the Sierra NF. Most of these have been discovered since 2005, showing that this species has until recently been overlooked and may be more common than previously thought. This small, delicate herb prefers bare soil around riparian areas with little competition, and based on new information gathered in recent years, it seems to thrive in areas with at least some disturbance (e.g. silt deposits in streambeds, ski runs, roadsides). The species ranges from Sierra County at Yuba Pass to Fresno County. ***One population of subalpine fireweed was found in a meadow 1,000 feet north of unit RX-08 on road 5S06.***

Short-leafed hulsea – *Hulsea brevifolia*

The short-leaved hulsea is a locally endemic perennial herb found in montane forests of the central and southern Sierra Nevada (Hickman 1993). Plants are 3 to 6 dm tall, with leafy stems. Leaves are toothed, and stems and leaves are covered with hairs, some of which are glandular, making plants sticky to the touch. Flowerheads are bright yellow-orange, less than 20 mm in diameter (Hickman 1993). Elevation range is from 5,000 to 9,000 feet, but most occurrences are found above 6500 feet in the red fir forest type. This plant grows in dry forests and openings.

Short-leaved hulsea is a perennial herb. There are about 46 occurrences documented on the Sierra National Forest, and others on adjacent forests and in Yosemite National Park. Elevational range is 5000 to 9000 feet, from Tuolumne County south to Tulare County. Habitat for short-leaved hulsea is gravelly or sandy exposed areas as well as densely wooded sites in coniferous forest, usually red fir forest. Occurrences range in size from a few dozen plants to many thousand plants. Most occurrences appear to represent a variety of age classes, from the current year's seedlings to older, well established plants (information on file at Sierra National Forest, North Fork, CA), and many populations consist of thousands of individuals. Five populations of short-leafed hulsea occur along Forest Roads 5S22Y and 5S06.

Veined water lichen – *Peltigera hydrotheria*

Veined water lichen is found in cold unpolluted streams in conifer forests along the western slope of the Sierra Nevada. The California occurrences are disjunct from other U.S. populations. This aquatic lichen is a foliose species with a delicate "leafy" thallus. It is a black "lettuce"-like lichen growing on rocks and on stream bottoms. Clumps range in size from a few centimeters to over a decimeter Reproductive structures have been observed, but how the lichen actually colonizes new habitats is unknown.

Threats are activities that change the water chemistry, alteration of the stream channel, excessive alteration of riparian vegetation thereby increasing water temperature or increasing flows that scour the gravels and rocks on which the lichen is attached. This species occurs in streams with clear, unpolluted, water. Peak flows are probably not of the intensity that would lead to scouring. The streams have a rich aquatic bryophyte flora (Shevock 1998). Increased sedimentation, nutrients, or a rise in temperature would significantly impact occurrences (Davis 1999).

The Sugar Pine Adaptive Management project area contains abundant suitable habitat for the veined water lichen, and ***one occurrence was found in 2007 within the project area, in the***

tributary to Lewis Creek flowing from the Westfall area. Additional stretches of perennially flowing water within the project area may contain additional veined water lichen populations.

Appendix A of the **Biological Assessment and Evaluation for Plant Species** provides a full list of the threatened, endangered, and sensitive plants that might be found in the Sierra National Forest, a summary of information about their biology and habitat, and rationale for including or excluding them in this analysis.

Noxious Weeds

Noxious weed species known to occur in the Sugar Pine project area are: bull thistle (*Cirsium vulgare*), foxglove (*Digitalis purpurea*), klamathweed (*Hypericum perforatum*), oxeye daisy (*Leucanthemum vulgare*), perennial sweet pea (*Lathyrus latifolius),* and Spanish broom (*Spartium junceum*). Other species that occur in the general vicinity and along roads leading to the project area are: yellow starthistle (*Centaurea solstitialis*), spotted knapweed (*Centaurea maculosa*), and medusahead (*Taeniatherum caput-medusae).*

Bull thistle is a biennial herb native to Eurasia that can grow to heights of 2 meters (Hickman 1993). It is fairly common in California, though less so at higher elevations or more pristine sites in the Sierra National Forest. Large plants can produce over 100,000 seeds (Randall 2000). Bull thistle tends to spread rapidly in disturbed meadows and in areas where soil disturbance favors weeds such as logged areas or areas cleared for fuels reduction (Randall 2000). There are over 300 infestations of bull thistle mapped within the Sierra National Forest, ranging from a few stems to infestations of several acres. There are 9 infestations within the Sugar Pine project area, mostly confined to roadsides and other disturbed areas such as old landings. Hand removal of plants within the project area occurred in 2007 and 2008, and will be conducted again in 2009 and into the future until infestations are eradicated.

Foxglove is a tall biennial herb native to Europe and Africa, originally introduced as an ornamental that tends to invade wet areas and streamsides. The plants are toxic to livestock and wildlife and can form monocultures in riparian areas to the exclusion of the native vegetation (Harris 2000). There is at least one small population of foxglove in the project area, possibly more along streamsides.

Klamathweed is a rhizomatous perennial native to Europe. Plants can form dense patches that eventually replace native plants and can cause severe problems for conifer regeneration (CDFA 2009). Spread is by seed and vegetative growth underground (CDFA 2009). Plants produce an average of 15,000 to 33,000 seeds, which can remain viable for up to 10 years and are spread by a variety of vectors, including tires and heavy equipment (CDFA 2009). There are over 100 infestations of klamathweed in the Sierra National Forest with several along roads leading to the Sugar Pine project area, and this is one of the fastest-spreading weeds in the Forest. One infestation of klamathweed was documented and hand-pulled in the project area in 2008.

Oxeye daisy is a rhizomatous perennial herb that has escaped cultivation in many areas of the West. Its potential for spread at high elevations is of concern. The oxeye daisy is native to Europe. It displaces native plants in wildlands. When infestations are not controlled early, they form large seedbanks of seeds that can remain viable for 20 years. Reproduction is by seed and by underground spread via the rhizomes (Alvarez 2000). There is a cluster of oxeye daisy along road 5S17, which is rumored to have originated from a large infestation on a nearby private parcel. Hand-pulling began in 2008 and will continue in 2009.

Perennial sweet pea is a perennial, sprawling, herb that has escaped cultivation and can form large masses that exclude native vegetation. There is at least one small infestation in the project area that should be easy to eliminate.

Spanish broom is an invasive shrub that is native to the southern Mediterranean region, originally introduced to California as an ornamental in the 1800s (Nilsen 2000). Shrubs spread in wildlands, excluding native plants and posing a fire hazard. There is a dense infestation of Spanish broom just south of Tenaya Lodge in the northwest portion of the project area within units proposed for fuels reduction activities. This area will be flagged for avoidance to ensure that seeds are not spread during project implementation.

Alternative 1 – No Action

Under the No Action alternative, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences. Known sites for botanical resources would continue to be managed to maintain present diversity of the species as specified in the LRMP (USDA-FS 2001a) and SNFPA ROD (USDA-FS 2004).

Direct Effects

No direct effects would occur to threatened, endangered, or Forest Service sensitive plants if the no action alternative is chosen because project activities would not take place.

Indirect and Cumulative Effects

Indirect and cumulative effects have the potential to occur to TES plants under the no action alternative primarily from the increased potential for uncontrolled wildland fire. Uncontrolled wildfire has the potential to cause significant disturbance to soil, ground cover and canopy cover, placing Forest Service sensitive riparian species at risk. For example, lady's slipper orchid populations could be extirpated if the canopy and soil organic layers were incinerated under extreme fire conditions (Kaye and Cramer 2005). The veined water-lichen population could be extirpated if the extreme heat prevailed for long enough to kill the thalli (plants) within the stream reach containing the lichens.

Except for under the most severe of fire conditions, which would kill all the seeds in the soil, the short-leafed hulsea would probably survive and perhaps ultimately benefit from wildfire as it tends to thrive along roadsides and in post-burn conditions (e.g. the Big Creek fire in 1994 resulted in vigorous recovery of short-leafed hulsea near Huntington Lake).

Uncontrolled wildland fire also introduces a higher potential for the spread of weeds through suppression actions. Fires can also allow the opportunity for the introduction and spread of invasive non-native weeds when seeds or contaminated soil area introduced, which can affect Forest Service sensitive species through competition for resources. However, the overall risk is probably about the same as under the action alternatives.

Alternative 2 – Proposed Action

Direct Effects

The following direct effects to sensitive plants are possible as a result of timber harvest or fuels reduction activities: Direct killing of plants when equipment runs over them or parks on them, when logs are skidded or dragged over them, when slash piles block their light, and when piles

are burned directly over them and the heat intensity is too great to survive. Mastication could directly kill plants by running them over or by covering them with a dense layer of chipped wood and limbs.

Indirect Effects

A possible indirect effect to sensitive plants is the degradation or loss of habitat resulting from the introduction or spread of noxious or invasive weeds. Noxious weeds are plant species that can spread rapidly and compete with native plants for water and other resources, in some cases forming solid stands of plants that may crowd out sensitive plant species. Noxious weeds can be transported by vehicles and heavy equipment when equipment passes through or excavates soil in contaminated areas and carries weed seeds to new areas. Risk of noxious weed introduction and spread can be greatly reduced by power washing all heavy equipment before bringing it onto the project site, as recommended by the Forest Service "Guide to Noxious Weed Prevention Practices (USDA-FS 2001b)." Noxious weed prevention measures have been incorporated into the design of this project, thus these indirect effects should be minimal.

Mountain lady's slipper orchid – *Cypripedium montanum*

Eight populations of lady's slipper orchids were discovered within the project area. Most are well within the riparian conservation zone and the streamside management zone (see aquatics design measures). Reducing canopy cover below 60% is thought to be damaging to lady's slipper orchids. Populations are often very small and isolated from each other; therefore, concerns exist related to population size, genetic fitness and the overall viability of the species (Kaye and Cramer 2005). However, in the past 5 years, at least 15 new populations have been found in the Sierra National Forest, varying in size from a few stems to more than a hundred bringing the total number of known populations up to 24 within the Sierra NF.

The eight known populations are well-protected from detrimental changes in canopy cover or soil parameters because they occur next to streams or are flagged for avoidance such that canopy cover will not be reduced and heavy equipment will not be allowed. If any new occurrences of lady's slipper orchids were to be discovered in the future they would be protected as follows (plants do not emerge every year therefore one year of surveying may not reveal all populations that are present): Any new populations would have a zone flagged around them where no timber harvest or heavy equipment would be allowed within approximately 60 feet (average tree height in the area). The buffer was determined to be sufficient to ensure that canopy cover remains at 60% or higher within the populations. Populations would also be monitored post-project to ensure that these measures were followed and to evaluate the status of the populations. The project design measures are expected to prevent any negative direct or indirect effects to the mountain lady's slipper orchids.

Subalpine fireweed – *Epilobium howellii*

Because meadow habitat will be protected by the project design measures for aquatic species (see EIS), and because the only population of subalpine fireweed occurs outside the project by at least 1000 feet, there will be no direct or indirect effects to this species.

Short-leafed hulsea – *Hulsea brevifolia*

Because any short-leafed hulsea populations will be flagged for avoidance prior to project implementation, there will be no direct or indirect effects to this species.

Veined water lichen - *Peltigera hydrotheria*

One new veined water lichen population was found during field surveys for the Sugar Pine Adaptive Management project, and more may exist in areas not directly surveyed (not every mile of perennial stream was surveyed). As this species is sensitive to water pollution and prefers cold clear water, any activities that alter water quality or raise water temperature could negatively impact plants and habitat. Because of the project design measures for RCAs prohibiting ground-disturbing activities within 100 feet of perennial streams, no negative effects are expected. In addition, stream temperatures will not rise as a result of the project because canopy cover will not change significantly near streams.

Cumulative Effects

The geographic boundaries delineated for surveys and subsequent effects analysis were defined by the boundaries of the Sugar Pine Adaptive Management Project area since this is where the proposed activities with potential effects on plant species are to occur. Table 3, on page 25 is a listing of past, present and reasonably foreseeable future activity within the project area utilized in determining cumulative effects on plant species.

This project and the subsequent maintenance and further vegetation work will move the areas treated closer to the pre-European natural range of variability for the area, except for possibly the areas where non-native annual grasses become more common after clearing.

Foreseeable future activity within the project area may include prescribed burning, ongoing vegetation maintenance by handwork or possibly heavy equipment, management of the plantations (thinning), and road maintenance. Other activities likely to occur include personal fuel woodcutting, recreational uses such as hiking, bike riding, OHV and dirt bike use, and dispersed camping.

Because suitable habitats for TES plants will be avoided and noxious weed mitigations will be implemented, negative effects to any undiscovered sensitive plants are expected to be minimal to non-existent for the Sugar Pine Adaptive Management Project, and therefore should not add to any cumulative effects of activities in the project area on sensitive plants.

Alternative 3

Direct, Indirect and Cumulative Effects

Effects for rare plants and noxious weeds would be the same as Alternative 2.

Alternative 4

Direct, Indirect and Cumulative Effects

Effects for rare plants and noxious weeds would be the same as Alternative 2.

Geology/Soils

Methodology for Analysis

Data used to determine existing soil conditions and projected effects to the soil resource include: the Soil Survey of the Sierra National Forest, (Giger 1993), site specific data from soil transects collected in 2007, following the Region 5 Protocol for Soil Monitoring (TenPas 2005) and past monitoring of similar projects using BMP Monitoring Protocols (USDA-FS 2002) and the Region 5 Soil Monitoring Protocol.

Effects of the proposed project will be similar to effects of recent, similar past projects implemented with current Best Management Practices and equipment that has been used in recent projects. These projects include the Cedar Valley Project, Graham Mountain Project, South of Shaver Project and several other similar projects.

Soil resource management is achieved by maintaining soil productivity using Regional Soil Quality Standard and Guidelines and management direction provided in the LRMP (USDA-FS 1991). Soil productivity is evaluated within an Activity Area. An Activity Area is the area of land dedicated to growing vegetation which soil quality standards for soil productivity are applied. It is that area within a management area where soil disturbing activities take place and is of practical size for management, sampling, and evaluation. Activity areas include timber harvest units and fuels treatment units within the Sugar Pine Project area. System roads and trails and other areas not dedicated to growing vegetation are not included as part of activity areas.

The project proposal could affect soil productivity in the Sugar Pine Project Area by reducing 1) soil porosity, 2) soil cover and 3) large woody debris and 4) displacement of surface soils.

The main soil physical property that can be affected by the proposed action is porosity, the space between individual soil particles. Soil hydrologic function is primarily dependent on the size and arrangement of soil pores, or pore geometry. Soil pore geometry also controls the transmission of air through soils, which is critical for plant growth. When porosity is decreased, the soil becomes denser, making it more difficult for roots to penetrate. Maintenance of natural soil porosity is important for maintaining healthy native plant communities and for maintaining the hydrologic function of the soil. Severe losses of porosity through soil compaction decrease the water and air available to plant roots, creating droughty and/or anaerobic conditions as well as physically inhibiting root growth. Soil hydrologic function is usually impaired as water storage capacity, infiltration, and permeability decrease, thus increasing runoff and the subsequent potential for erosion and cumulative watershed effects. Soil compaction diminishes soil porosity, and decreases the transmission of water, nutrients, and air to roots. Severe compaction can inhibit root growth when the soil becomes too dense for roots to penetrate easily. Finally, compaction decreases infiltration and hydraulic conductivity, the movement of water into and through soils, which in turn increases surface runoff and erosion potential. Severely compacted soils could take at least 50 years to recover. Bulk density (ratio of soil mass to soil volume) and soil strength (penetration resistance) are two widely accepted indirect means of measuring changes in porosity in the field. Qualitative indicators of compaction include platy soil structure, loss of soil structure (e.g. puddling), impressions or ruts in the mineral soil surface, and in some cases, redoximorphic features that indicate a recent change in soil aeration. Redoximorphic features are soil properties associated with wetness that results from reduction and oxidation of iron and manganese compounds after saturation and desaturation with water. Both quantitative and qualitative indicators will be used to describe compaction. Use of heavy equipment, especially rubber tired

skidders, for logging and tractor piling could compact soils, in the upper 12 inches of the soil profile. Soil compaction can have a detrimental effect on soil productivity on fine-textured soils that are moist or at optimal soil moisture conditions for soil compaction. Soil compaction is not a concern in coarse textured soils. In fact, soil compaction has been found to have an increase in soil productivity by increasing the available water holding capacity of the soil (Powers, et al 2008). Soils have been classified into sensitive and non-sensitive soils types for the purpose of identifying soils that are susceptible to detrimental soil compaction. *Soil porosity should be at least 90 percent of total porosity over 85 percent of an activity area (stand) found under natural conditions. A 10 percent reduction in total soil porosity corresponds to a threshold for soil bulk density that indicates detrimental soil compaction.*

Soil productivity is dependent on the amount of soil organic matter available to prevent significant short or long-term nutrient cycle deficits, and to avoid detrimental physical and biological soil conditions. Soil organic matter should include fine organic matter and large woody debris.

Fine organic matter provides soil nutrients and protects the soil by providing soil cover. Soil cover or the lack of soil cover can affect soil productivity by removal of surface soils from accelerated erosion. Accelerated erosion is erosion that occurs at a rate over and beyond normal, natural or geological erosion, primarily as a result of human activity. Soil loss should not exceed the rate of soil formation (approximately the long-term average of 1 ton/acre/year). Sufficient soil cover should be maintained to prevent accelerated soil erosion from exceeding the rate of soil formation. Ground cover will be at least 50% on ground slopes less then 35% and on slopes greater then 35%, ground cover will be determined by the interdisciplinary (ID) team. Replenishment of fine organic matter to preexisting conditions could occur in less then 10 years as forests shed their needles and leaves and accumulate on the forest floor.

Large organic matter or large woody debris, provides habitat for soil micro-organisms including fungus, soil insects and soil bacteria. All of these organisms are critical for soil health and soil productivity. The loss or reduction of large woody debris in a forest could last anywhere from 10 to 50 years, depending on the number of decadent trees or snags that are left in the stand after treatment. At least five well-distributed logs per acre, representing the range of decompositions classes, should be left on the forest floor after the proposed action is completed.

Soil productivity can be reduced or impacted from displacement of surface soils. Surface soils include valuable amounts of organic matter and nutrients that are critical for productive soils. Surface soils can be disturbed by logging and mastication equipment operating in the forest, by tractors piling slash and by construction of roads and skid roads from excavation of the soil to construct a road or skid trail prism. The surface area of new roads will result in a loss of soil productivity for that area. Disturbance of surface soils by logging and mastication equipment could result in reduced soil productivity. The Sierra NF LRMP provides direction for avoiding tractor logging on sustained slopes that exceed 35% (USDA-FS 2001a). There are no slope limitations for mastication equipment in the LRMP. Mastication equipment can operate on slopes up to 55% slopes. There has been no systematic monitoring of mastication work on slopes greater then 35% on the Sierra National Forest.

The following information addresses the affected environment or existing pre-treatment soil condition, the environmental consequences of the proposed action to soil productivity; mitigations measures proposed to reduce the impacts of the proposed action and a monitoring plan to ensure that Forest Standard and guidelines are met to maintain soil productivity.

Affected Environment

Soils in the proposed project area vary in their sensitivity to management. Soils with higher clay content and soil moisture have the highest potential to reduced soil porosity. Soil compaction can occur down to 12 inches deep.

- There is a concern that areas proposed for ground based harvest have soils that are highly susceptible to reduction of soil porosity caused from compaction by heavy equipment operating when soils are moist or wet.
- There a concern that prescribed fire and tractor piling will reduce soil cover and accelerated erosion could result in a loss of soil productivity.
- There is a concern that ground based harvest systems on slopes that are too steep will displace surface soil horizons that could result in accelerated erosion and reduced soil productivity.

The area is underlain with nine soil types that combine into nine soil map units. The most dominant soils affected by the project include: Holland family, Chaix family, Chawanakee family, Ledford family, Entic Xerumbrepts, Neuns family, Umpa family, Cagwin family and Lithix Xeropsamments. Rockout crop is secondary component of several soil map units and is located throughout the treatment areas. The soils vary in characteristics from shallow to deep, thermic to frigid temperature regimes, xeric moisture conditions and have developed in metamorphic and granitic parent materials (Giger 1993). A map of the Soil Map Units and complete unit tables are included in the Soils Report available in the project file. Table 5 displays a summarization of this information.

Table 5. Summary of Soil Map Units

MUSYM	MUNAME	Sensitive	Acres
137	Holland Family, 35 to 65 Percent Slopes	Yes	934
136	Holland Family, 5 to 35 Percent Slopes	Yes	488
123	Chaix-Chawanakee Families-Rock Outcrop Complex, 35 to 65 Percent Slopes	No	446
143	Ledford Family-Entic Xerumbrepts-Rock Outcrop Association, 10 to 45 Percent Slopes	No	265
140	Holland-Chawanakee Families Complex, 35 to 65 Percent Slopes	Yes	245
146	Neuns Family, 25 To 60 Percent Slopes	No	176
124	Chaix-Holland Families Complex, 15 to 35 Percent Slopes	Yes	155
176	Umpa Family, Deep, 20 to 60 Percent Slopes	No	75
114	Cagwin Family-Lithic Xeropsamments-Rock Outcrop Complex, 45 to 65 Percent Slopes	No	2

Some of the proposed treatment units are underlain with multiple soil types and multiple soil map units. The western part and lower elevations of the proposed project area is underlain with Holland soils. Holland family soil consists of deep, sandy loams and sandy clay loams that are well drained. Holland soil is the only soil in the Sugar Pine Project area that is a sensitive soil. Holland family soils have a moderate soil compaction hazard and high to very high maximum

erosion hazard rating. These soils are most susceptible to compaction when soils are moist and are very erosive without adequate soil cover. Holland soils occur in soil map units 124, 136, 137, and 140. Holland soils are deep (60 to 66 feet), well drained soils with a sandy, clay loam subsoil. These soil map units occur in treatment areas M2, M6, M7, M8, M9, M10, M11, M12, RX3, RX5, T16, T3, T4, T5, T6, T7, T8, T9, T10, and T11.

The middle part of the proposed project area is underlain with Soil Map Units 123 and 146. Soil types within these soil map units include Chaix, Chawanakee and Neuns family soils. Chaix family soils consist of moderately deep to deep, coarse sandy loams that are somewhat excessively drained or well drained. Chawanakee family soils consist of shallow, coarse sandy loam that is somewhat excessively drained. Neuns family soil consists of moderately deep to deep, gravelly loam and cobbly loam that is well drained. Neuns family soil has 25% pebbles and/or rock fragments. The Chawanakee soils are susceptible to loss of soil productivity from displacement of the surface soils. The Neuns family soil has a moderate erosion hazard rating and is difficult to compact because of the rock fragment content. Treatment areas M1, M4, M5, RX1, RX2, T2, and the east end of T15 are underlain with Soil map Unit 123, which includes Chaix, Chawanakee family soils and rock outcrop. Treatment area M4 is underlain with Soil map Unit 146, which includes Neuns family soil. Treatment area T3 is underlain with Soil Map Units 140 and 146, which includes Holland family soils in the lower elevations and Neuns family soil in the upper elevations of the unit. Treatment area T7 is underlain with Soil Map Units 124 and 136, which includes Chaix family soils and Holland family soils.

The eastern part of the proposed project area is underlain with Soil Map Units 143 and 176. Soil types within these soil map units include Ledford family soil, Entic Xerumbrepts, Umpa family soils and rock outcrop. A Ledford family soil consists of deep, coarse sandy loams that are somewhat excessively drained. Entic Xerumbrept soil consists of shallow, sandy loams and coarse sandy loams that are somewhat excessively drained. These Entic Xerumbrepts soils are susceptible to loss of soil productivity from displacement of the surface soils. Umpa family soil consists of deep, bouldery and stony coarse sandy loam that is well drained and moderately well drained. This area has approximately 15% rock outcrop distributed throughout the area.

Soil map units with high amounts of impervious surfaces such as rock outcrop or shallow soils are most susceptible to runoff and subsequent surface erosion of soils adjacent to the rock outcrop. Shallow soils and/or rock outcrop occur in soil map units 123, 140, and 143. Chawanakee family soils are shallow (<20 inches), somewhat excessively drained with a coarse sandy loam surface soil and subsoil. Entic Xerumbrepts soils are shallow (<18 inches), somewhat excessively drained or excessively drained with a sandy loam surface soil. The Chawanakee soils are susceptible to loss of soil productivity from displacement of the surface soils. The Chawanakee soils are also susceptible to accelerated erosion from runoff off the rock outcrop, especially if adequate soil cover is not available. Treatment areas that occur in these soil map units include: M1, M11, M-14, M-16, M-20, M5, M7, M8, RX-07, RX-08, RX1, RX2, RX3, RX5,T2, T3, T4, T5, T7, T9, T10, T15, T16, T-23, T-24, T-26, T-30, T-31, T-32, T-33, T-35, and T-37 (see Table 6).

Areas proposed for ground based harvest systems are generally less than 35%. However, some areas exist where slopes exceed 35% and tractor logging could result in soil disturbance that mixes or removes soils below the A horizon. Commercial thin units with sustained slopes greater then 35% include T2, T4, T5, T7 and T10. Mastication units with sustained slopes greater then 55% include M1, M4, M5, and M7.

Table 6. Treatment Areas with Greater than 35 Percent Slopes

> 35 Slopes > 55		Slopes > 55%	
Unit_ID	Acres	Unit_ID	Acres
M1	29	M1	8
M2	23	M2	2
M4	8	M4	2
M5	52	M5	13
M6	17	M6	1
M7	17	M7	5
M8	6	RX1	27
RX1	61	RX3	7
RX3	4	T10	3
T10	33	T2	2
T12	4	T3	3
T13	4	T4	6
T2	15	T5	3
T3	47	T6	2
T4	61	T7	1
T5	6		
T6	41		
T7	17		
T8	15		
T9	2		

Soil conditions have been reviewed in the Sugar Pine Project Area. Soil data along 12 soil transects were collected using the 20 point transect method and soil data along 6 soil transects were collected using the line transect method to characterize soil conditions using the 2005 Framework Soil Monitoring Methods Protocol and a soil monitoring protocol known as the Iron Canyon Intensive Soil Monitoring Protocol (TenPas 2005; Gallegos 2007). Data for soil cover, soil disturbance, soil compaction and large woody debris were collected along these 18 transects and summarized. This report documents baseline conditions from which to compare soil conditions in the future (see Table 7).

Table 7. Summary of Transect Data

Transect	Unit Number	Soil Cover	Slope	D1	D2	D3	Total Disturbance	LWD (acre)	Percent Unit Detrimental Comp/Dist	Core Samples
M6	SP-TR-9	96	37	5	0	0	5	18	0.00%	1
T3	SP-T1-1,SP-T1-2,SP-T1-3	94	20	27	0	0	27	102	9.67%	31
T4	SP-TR-7,SPTR--8	97	26	18	3	5	25	113	10.00%	6
T7	SP-TR-3	86	21	20	15	0	35	0	5.00%	3
T8	SP-TR-5,SP-T2-1,SP-T2-1,SP-T2-3	91	31	24	8	1	33	100	9.00%	38
T10	SP-TR-1,SP-TR-2,SP-TR-4,SP-TR-6	91	21	19	3	5	26	45	2.50%	10
T26	SP-TR-14	62	16	5	5	15	25	20	15.00%	3
T32	SP-TR-13,SP-TR-15	76	14	18	3	5	25	122	2.50%	6
Average		**87**	**23**	**17**	**4**	**4**	**25**	**65**	**6.71%**	**98**

Soil transect data indicates that soil cover and large woody debris are meeting Regional Soil Standard and Guideline thresholds. The average soil cover is 87% and the average number of large woody debris (LWD) is approximately 65. Several areas within the proposed project area are currently not meeting Regional Standard and Guideline thresholds for detrimentally disturbed soils. See Table 8 for description of soil disturbance classes. The average for detrimental disturbed soils throughout the project area is approximately 6.71%. Detrimentally disturbed soils include those areas with D3 soil disturbance or detrimentally compacted soils. Detrimentally compacted soil is where soil porosity is below 90 percent of total porosity found under natural conditions. A 10 percent reduction in total soil porosity corresponds to a threshold soil bulk density that indicates detrimental soil compaction. Some areas have soil compaction or detrimental soil disturbance as high as 15 to 20 percent.

The middle of the treatment area T3 has approximately 20% of the area with detrimentally disturbed soils. Treatment area T3 overall has approximately 9.67% of the area with detrimentally disturbed soils. Treatment area T4 has approximately 8% of the area with D2 and D3 soil disturbance and 10% of the area with detrimentally compacted soils. Treatment area T7 has approximately 15% of the area with D2 soil disturbance and 5% of the area with detrimentally compacted soils. Treatment area T8 has approximately 9% of the area with D2 and D3 soil disturbance and 9% of the area with detrimentally compacted soils. Treatment area T10 has approximately 8% of the unit with D2 and D3 soil disturbance and 2.5% of the area with detrimentally compacted soils. Treatment area T26 has approximately 20% of the area with D2 and D3 soil disturbance and 15% of the area with detrimentally compacted soils. Treatment area T32 has approximately 8% of the area with D2 and D3 soil disturbance and 2.5% of the area with detrimentally compacted soils.

Table 8. Description of Disturbance Classes

D0 – Undisturbed	D1 – Slightly Disturbed	D2 – Moderately Disturbed	D3 – Highly Disturbed
Soil Surface: - No evidence of equipment operation	Soil Surface: - Light tracks, slight depressions - Duff and litter cushion mostly in place - Topsoil in place	Soil Surface: - Clear tracks - Duff and litter displaced, or reduced - Topsoil exposed and mixed or compacted	Soil Surface: - Prominent tracks, main skid trail or landing - Duff and litter displaced - Topsoil highly compacted, and/or eroded
Compaction: - Soil has natural structure and resistance to spade	Compaction: - Soil strength increase in top 4 inches - Structure changes in top 4 inches	Compaction: - At threshold of detrimental compaction - Soil strength increase in top 4 to 8 inches - Some structure changes below 4 inches - Platy or massive structure is generally continuous	Compaction: - Soil strength and spade resistance increased to depth > 8 inches - Structure changes continuous to 8 inches - Platy or massive structure

Alternative 1 – No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. No thinning, either commercial, pre-commercial and/or biomassing, of mixed conifer and pine stands, mastication of brush/shrub patches, prescribed burning to reduce natural fuel accumulations and/or treatment of infestations of noxious weeds and replanting of conifers in failed conifer plantations would be implemented to accomplish the purpose and need.

Direct Effects and Indirect Effects

Under the Alternative 1, soil conditions would not change from the existing conditions. Soil transect data indicates that soil cover and large woody debris (LWD) are meeting Regional Soil Standard and Guideline thresholds. Soil cover will increase and LWD will increase. The average soil cover is 87% and the average number of LWD is approximately 65. This is well over the guideline of five logs per acre. Several areas within the proposed project area are not meeting Regional Standard and Guideline thresholds for detrimentally disturbed soils. Some areas have 15 -20% detrimentally disturbed and compacted soils. The average throughout the project area for detrimental disturbed and compacted soils is approximately 6.71%. Compacted soils will continue to recover over time.

If vegetation is left in its current state of high fuels and high wildfire risk, it is inevitable that a wildfire will occur. Many areas within a potential wildfire area would not meet soil quality standards in terms of soil cover and surface erosion rates in a fire event. Soil cover would be less then 20% and some soils would develop hydrophobic conditions. Accelerated erosion will occur, especially during precipitation events. Soil loss could range from 10–60 tons per acre in these areas. Soil Productivity will be reduced in some areas by at least one site class. Past monitoring of wildfire areas on the nearby Stanislaus National Forest has found that bare ground averaged about 70% by spring of the first year and by spring of the second year bare ground averaged 27% (Janicki 2003). In a study conducted by Berg and Azuma (2007) bare ground and evidence of surface erosion recovered to pre-fire conditions within four to five years after a wildfire. Large woody debris would probably be consumed in a fire and long term soil productivity could be decreased without large woody debris.

Cumulative Effects

Cumulative soil effects have been addressed under the cumulative watershed effects (CWE) section under the Hydrology/Water Quality Section. Analysis of cumulative soil effects use the Equivalent Roaded Acre (ERA) Model, which is used in the CWE analysis. The ERA model quantifies disturbance based on the degree of disturbance as compared to an acre of road and measured relative to disturbance in a given watershed. ERAs reflect changes to Soil Hydrologic Function, and are an indicator of rutting potential, erosion potential and loss of water control. See Sugar Pine Adaptive Management Project CWE Analysis (Gallegos 2008) for a full description of assessment and assumptions including list of past, present and future foreseeable actions. The Forest Service Pacific Southwest Region (R5) methodology is used to determine the overall disturbed footprint. The disturbed footprint is a semi-quantitative measure of acres of detrimental soil disturbance and hence an approximation of change in Soil Quality as defined by the R5 Soil Quality Standards (USDA-FS 1995).

The Sugar Pine CWE Assessment modeled recovery from previous management actions over a 30 year time span for 12 subdrainages for the existing condition and No Action Alternative. Two of those subdrainages (501.5053 and 503.0055) are currently exceeding their lower threshold of concern for cumulative watershed effects. A detailed field assessment of those subdrainages did

not find any evidence that cumulative watershed effects was occurring. Other planned actions that are not part of this decision would still occur, but the total ERAs in the project sub-watersheds would be lower than if the project was implemented.

Alternative 2 – Proposed Action

Treatment areas within the project area were delineated to include those areas where some form of treatment was necessary to meet the purpose and need. First treatment areas were designed to create SPLATs to reduce the intensity and spread of wildfires in and around WUI. Treatment areas near key transportation corridors (for egress and ingress into the community) and within the defense zone of the WUI were designed next. These treatment areas are designed to focus on those treatments needed to meet fire and fuel objectives (lower and limited mid-level canopy treatments), but the forested stands within the project area are also considered overstocked with conifers (basal area and stand densities that are greater than can be sustained with changing environmental conditions). Treatment areas were further designed to address these areas. There would be approximately 2,920 acres treated. The acres displayed in the affected environment section are the total acres of the treatment unit polygons, including Streamside Management Zones, rock outcrop and other areas that will not be treated. Whereas the following proposed treatment acres are the estimated acres that will actually be treated.

Direct Effects and Indirect Effects

The following is a discussion of the various kinds of treatments proposed and their potential direct and indirect effects to the soil resource.

Commercial and Biomass Thinning activities (mechanical harvesters), Mastication operations, Pre-commercial Thin/Release operations, and Tractor Piling operations use equipment that includes steel tracked heavy equipment and rubber tired tractors. These activities have the potential to impact the soil resource by mechanically disturbing the soil or compact the soil. Planting and hand release operations do not effect the soil resource.

Soil Disturbance and Soil Porosity or Soil Compaction

Mechanical harvesters and rubber tired tractor skidders used for the proposed commercial and biomass thinning, tractor piling, and mastication will cause soil disturbance and their use poses increased risk of detrimental soil disturbance, detrimental soil compaction and accelerated soil erosion. Standard operating procedures such as cross ditching skid trails for erosion control will reduce the risk of erosion and promote surface soil stabilization and re-vegetation. Tractor logging is planned for areas with slopes under 35%, which will reduce excessive soil displacement. Areas of slopes in excess of 35% should be logged with a cut-to-length logging system or logs should be favorable skidded to prevent undue soil disturbance. The soils in this project area are highly productive so rapid natural re-vegetation is expected.

Holland soils are highly susceptible to soil porosity loss, due to compaction from heavy equipment, such as rubber tired skidders and mechanical harvesters operating when soils are moist or wet. Holland soils occur in treatment areas T3, T4, T5, T6, T7, T8, T9, T10, T11, and T16. These units are highly susceptible to detrimental soil compaction exceeding 15% of the treatment area. Treatment areas T3, T4, and T8 have detrimentally compacted soils at 9-10% and treatment area T26 has detrimentally compacted soils at 15%. Parts of treatment area T3 and T8 have detrimentally compacted soils at 20%. These treatment units will probably exceed 15% of the treatment unit in detrimentally compacted soils immediately after the first phase of project implementation.

In order to minimize detrimental soil compaction, soil moisture needs to be dry enough to reduce the susceptibility to compaction during thinning and biomass removal operational periods. The ideal moisture content varies between soils and should not be above 12% to prevent soil compaction. A soil scientist or other earth scientist will be consulted prior to mechanical equipment operating on soils that have a moderate soil compaction hazard. The standard operating period from June 1 to October 15, and avoidance of operating mechanical equipment on soils with more then 12% soil moisture should minimize detrimentally compacted soils in an average rain year (See Soil Design Measure 2 and 3).

Areas with detrimentally compacted soils should be less then 15% for most of the treatment areas. Some portions of the commercial thin or biomass treatment areas (Units T3, T4, T8, and T26) will have detrimentally compacted soils in excess of 15% until subsoiling is completed in the unit. Subsoiling will occur after the last mechanical treatment is needed, generally the 2nd year after the initial commercial thinning operation or biomass treatment. Detrimentally compacted soils in excess of 15% will probably occur for at least 1 year, until after tractor piling of slash has occurred in the second year of project implementation. Subsoiling landings (BMP 1-16) and primary and secondary skid trails should result in less then 15% of the treatment areas with detrimentally compacted soils. Soil productivity will be reduced in areas with detrimentally compacted soils for 1 or 2 years.

There are no potential indirect effects of the proposed action if soil compaction is kept to less than 15% of an activity area and erosion control measures are implemented in a timely manner. There could be an occasional summer storm event that could cause accelerated erosion of bare exposed soils. In the event that this should occur soil erosion sites will be restored to pre-storm conditions.

Large Woody Debris (LWD)

Commercial thinning, biomass removal and tractor piling will probably reduce existing fuel loads to levels where fire hazards and fuels have been reduced to achieve the desired conditions for the Wildland Urban Interface. After treatment, on the ground fuel loads are expected to be no more then 5 – 10 tons/acre (see Fire/Fuel Section). This will probably reduce existing LWD to at least 25% of existing levels, which will be higher then the minimum five logs per acre that is needed to meet the Soil Standard and Guideline Threshold for LWD.

Soil Cover

In areas where tractor piling of slash is planned, it is a normal Sierra NF practice to leave at least 50 percent, well distributed soil cover for erosion protection on slopes under 35%. If slopes are greater then 35%, soil cover should be at least 70%. Past observations on the Sierra NF have found that this amount of soil cover generally prevents accelerated erosion. A buffer of 100 feet will be provided around rock outcrop to prevent accelerated erosion of the adjacent soils from rapid runoff from rock outcrops.

Mastication Treatment Areas

Areas planned for mastication pose little risk of reducing soil productivity. This includes all of the M treatment areas, including M4, which is proposed for Fuel Break Maintenance. The masticator equipment reduces erosion potential by increasing soil cover and generally causes little soil disturbance and compaction. Soil masticating equipment generally does not result in compacted soils because the equipment has lower ground pressures then conventional logging equipment and because this treatment creates a bed of chips that the masticator travels over. All mastication treatment units have slopes in excess of 35%. Most mastication treatment will be on slopes less

the 35%; however some areas with slopes in excess of 35% will be treated. This will probably occur in treatment areas M1, M5 and M7. A minor amount of soil disturbance will probably occur where the masticator makes turns during the operations. Soil disturbance will be higher on steeper slopes.

Prescribed Fire

Areas planned for prescribed fire pose little risk of causing significant effects to soil productivity based on the past performance of the prescribed fire program on the Sierra National Forest. Past prescribed fires on the forest has resulted in low burn severity in most areas. Prescribed fire burns in a mosaic pattern leaving patches of unburned vegetation and patches of burned areas, where duff and litter is completely consumed. Most trees are left undamaged, except for a few small patches that have burned at a moderate burn severity. Soil quality standards have been met from past prescribed fires and are expected to be met from the proposed action. Soil cover of 50% is expected to be met in the prescribed fire treatment areas.

Road Construction

Approximately 0.7 miles of new and temporary road construction is proposed for the Sugar Pine Project. Road construction results in removal of surface soils and subsoil and complete loss of soil productivity within the road prism. The 0.7 miles of road is approximately 1.2 acres of ground with total loss of soil productivity. The direct effect of this new road construction is irreversible and irretrievable. Erosion on newly constructed roads is usually higher immediately after the road is constructed. There is potential that accelerated erosion could occur off the road prism and reduce soil productivity off site and after the road is constructed. Applicable soil and water conservation Best Management Practices (BMP) will be implemented, including erosion control measures, such as water bars, straw mulching of fills and fertilization of soils to re-vegetate the bare soils. Road reconstruction and road maintenance operate within the road prism and have little effect to the soil resource. However, there can be a positive effect to the soil resource out site of the road prism from road reconstruction by restoring proper drainage features of the road. Restoration of drainage features will result in less surface erosion and soil loss that leads to loss in soil productivity.

Cumulative Effects

Cumulative soil effects have been addressed under the cumulative watershed effects (CWE) section under the Hydrology/Water Quality Section. See the discussion in the No Action Alternative, Soil Cumulative Effects section for additional discussion on soil cumulative effects. The Sugar Pine CWE Assessment, modeled disturbance from the proposed action and recovery from previous management actions over a 30 year time span for 12 subdrainages. Five of those subdrainages (501.5006, 501.5007, 501.5053, 503.0010 and 503.0055) will exceed their lower threshold of concern for cumulative watershed effects after the project is implemented, but not their upper Threshold of Concern of 14%. A detailed field assessment for subdrainages 501.5053 and 503.0055 did not find any evidence that cumulative watershed effects was currently occurring. Implementation of Soil and Water Conservation Best Management Practices and other design measures, including subsoiling of detrimentally compacted soils will minimize effects to the soil resource. No significant impacts to soil productivity are expected if soil cover is over 50%, detrimental soil disturbance and detrimental soil compaction is limited to no more then 15% of a treatment unit; and large woody debris is at least five logs per acre.

Alternative 3

In Alternative 3, treatment areas and the types of treatments would remain the same for all areas, as in Alternative 2, except for those portions of treatment areas T-4 and T-3 that are designated within the 700-acre Pacific Fisher den site buffer (as established by SNFPA ROD 2004, S&G #85 and #86) for known den sites. Treatments would be altered within the den site buffer to treat the lower and limited mid-level canopy (surface and ladder fuels) to address fire and fuels objectives within WUI. There would be no additional treatment of the mid-level canopy (stand density) within the den site buffer. All other treatment areas would continue to have treatments similar to those listed in Alternative 2, which includes treatment of lower and middle level canopies. There would continue to be approximately 2,920 acres treated under Alternative 3.

There is virtually no difference between Alternative 2 and Alternative 3 to the soil resource (see effects analysis for Alternative 2). The only difference between Alternative 2 and 3 is an additional limited operating period for treatment areas T3 and T4. The same acres will be treated, but fewer larger trees will be removed in treatment areas T3 and T4. These fewer trees result in fewer trips with mechanical equipment, but this will probably have no measurable effect.

Alternative 4

In Alternative 4, treatment areas would remain the same as in Alternative 2, but the treatments within these areas would include only those needed to reduce the surface and ladder fuels (within the lower and limited mid-level canopy levels) needed to achieve fire and fuels objectives. Under Alternative 4 there would be no additional treatments (i.e. additional thinning in the mid-level canopy) to fully address stand density/forest health objectives.

This alternative would, in effect, assume the entire project area as a Pacific Fisher den site, whereby, it would be treated to achieve fire and fuels objectives for the urban wildland intermix zone and limit treatments to mechanical clearing of ladder and surface fuels. As such, all design criteria and SNFPA ROD (USDA-FS 2004) standards and guidelines associated with Pacific Fisher den sites would be implemented with this alternative.

This alternative was developed to address the issue listed on page 6. As well, this alternative is being analyzed in detail to measure the effects as they relate to focusing treatments on fire and fuels objectives without additional treatment for forest health (stand density). There would be approximately 2,920 acres treated under Alternative 4.

There is no difference between Alternative 2 and Alternative 4 to the soil resource (see effects analysis for Alternative 2). The only difference between alternative 2 and 4 is an additional limited operating period for the whole project area. The same acres will be treated, but those acres that are proposed for commercial thinning in Alternative 2 will be treated for biomass removal. Fewer larger trees will be logged in the T treatment areas. The same equipment will be used to remove the biomass and the potential for disturbing soils is similar to Alternative 2.

Lands/Special Uses

Affected Environment

There are numerous land-type special uses authorized under permit within the project area including: water systems (spring developments, water lines and storage tanks) that provide potable water to Sugar Pine Camp/Yosemite Mountain Railroad, and for an individual residence; buried fiber optic and telephone lines; a telephone carrier site along the Sugar Pine Road 630; overhead and buried electrical lines; the Madera Irrigation District's gauging station; private and County roads; signs, and apiary sites.

Recreation special uses authorized under permit in the project area include the Yosemite Mountain Sugar Pine Railroad (YMSRR) and Yosemite Trails Pack Station (YTPS). The YMSRR operates the railroad 6 months a year between March and October; however, their peak visitor season is between June and mid-August.

The Yosemite Trails Pack Station offers horseback rides three seasons of the year from their pack station headquarters. In addition, YTPS offers horse driven sleigh rides during winter months when snow conditions are favorable from a secondary location south of Tenaya Lodge. The YTPS is authorized to use and maintain some of the horseback riding trails they take their clients on.

The Lewis Creek Recreation Trail crosses through the southern portion of the project area.

Map 5, found in the Map Package in Appendix A, identifies the permitted special uses found within the project area and how they relate to the proposed treatment areas.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under the No Action alternative, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected. This would include all current uses as permitted.

While special use permittees would continue to perform hazardous fuels reduction around the facilities they operate, they would be limited to the standard 100 feet required by the State of California. Like the community of Sugar Pine, there would be no added protection from moderate to high intensity fires.

The continuation of natural fuels build-up could pose a wild fire threat to permit holder improvements, and for commercial permit holders, a loss of revenue. Overstocked stands have the potential to be effected by epidemic infestations of bark beetles and, in combination with disease, and/or drought-induced mortality, the forested areas the commercial permit holders depend on for their livelihood are at risk. Commercial permit holders would likely experience loss of revenue because forest visitors they depend on may be hesitant to visit parts of the forest that have high tree mortality. As public safety concerns (mainly from snag densities and high fire danger) began to increase there would be the potential need for areas to be closed to public access.

Alternative 2 – Proposed Action

Direct, Indirect and Cumulative Effects

Alternative 2, like the No Action alternative, would not change the management and currently permitted activities within the project area. The activities associated with the proposed action would include commercial, pre-commercial and biomass thinning of conifer stands and prescribed burning (understory and pile) with associated post-activity treatments. These are the actions that have the largest possibility of effecting special use permitted operations. Design criteria were developed to minimize the impacts that could occur from the implementation of this alternative and are listed on pages 12-13.

Alternative 3

Direct, Indirect and Cumulative Effects

The effects of this alternative would be similar to that of Alternative 2.

Alternative 4

Direct, Indirect and Cumulative Effects

The effects of this alternative would be similar to that of Alternative 2.

Terrestrial Wildlife

Affected Environment

Species specific habitat needs as well as the habitat availability within the project area are listed within the following effects analysis by species. The effects analysis further describes the changes to this habitat for each alternative. When describing vegetation aggregates as it relates to wildlife habitat California Wildlife Habitat Relationship (CWHR) mapping is used. Map 6, found in the Map Package, Appendix A, shows these CWHR types for the project area. Tables 40 and 41, in Appendix D, show the existing acres by CWHR type and changes to CWHR type, if any, from treatments in each action alternative.

Mitigation and Monitoring

Within this project area under the action alternatives, special considerations have been given to perennial streams to leave higher levels of biodiversity (see EIS and BE/BA for a description of Old Forest Linkages), higher levels of biodiversity are planned for retention around large oaks and large tree groups have been designated across the project area which will advantage those species which utilize dense large tree groups and their prey species. Surveys will be conducted for California spotted owls and northern goshawks prior to implementation of any project activities, as well, surveys for these species will be conducted on a schedule as outlined in the LRMP, as amended, during project implementation (USDA-FS 2001a). Additionally, as a result of the involvement of UC Berkeley as a part of the SNAMP project, fisher activity in the project area will be intensively monitored.

Alternative 1 – No Action

Direct Effects

There would be no direct effects to any terrestrial wildlife species under this alternative.

Indirect Effects

The continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands the eventual changes through drought stress and subsequent insect and disease mortality acceleration, the threat of stand replacing fire would be exacerbated. Additionally, the high probability of a drying climate change in the Western United States would potentially further compound these effects.

Cumulative Effects

According the Council on Environmental Quality (CEQ) NEPA regulations, “cumulative impact” is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR 1508.7). Effects are spatial and temporal. In determining cumulative effects, the effects of the past, present and future actions were added to the direct and indirect effects of the proposed action and alternatives. Table 2 on page 25 of this document list those activities.

Under Alternative 1, no additional cumulative effects will occur.

Alternative 2 – Proposed Action

This alternative leads to a lower level removal of larger trees within the project treatment units. Those areas within the current fisher den site buffer would be reduced to a removal of surface and ladder fuels. While no currently designated habitat (PPN, SMC, MHC and RFR, 4D and 5D types) are intended to be reduced below those designations, understory and some co-dominates will be removed. Those 4D and 5D habitat types have been identified as being the most important to old growth species such as California spotted owls, northern goshawks or Pacific fisher for denning, resting and breeding habitat. None of those habitats will be reduced to less than their current designation. This alternative will lead to higher growth rates amongst the remaining stems, leading to old growth characteristics the fastest and reduce potential mortality from drought stress and subsequent beetle and disease mortality.

Direct Effects

The most probable direct effect to species will be a noise disturbance effect, potentially leading to an energetic response in avoiding project activities. No direct mortality from project activities would be expected as complete surveys of old forest threatened, endangered or sensitive (TES) species will be completed prior to project activities occurring and those locations and an appropriate perimeter around them would be avoided until after the appropriate Limited Operating Periods are completed. With respect to the Pallid bat, which is known to use sloughing bark of large snags, every effort would be made to avoid damaging or removing those snags.

Indirect Effects

Maintenance of the highest areas of biodiversity Old Forest Linkages (OFL), and oak understory characters as well as large tree groups will provide cover for species of concern and their prey. It is poorly understood as to the rate of recovery of those areas that are manipulated; whether they will be immediately begin to be reused by old forest species or whether there will be some lag time. That is one of the questions we are attempting to address with the Universities Sierra Nevada Adaptive Management Study; however, it is expected that without some form of density management of the stands, eventual higher levels of mortality and reduced growth rates within those stands will occur. With respect to stand-replacing wildfire events, this alternative provides the highest level of protection possible without diminishing the ability of those stands to support species of concern and their prey.

Cumulative Effects

This area includes private in-holdings, permanent roads, dispersed camping, occasional Off-Highway vehicle use, and day-use areas, and several timber plantations. Road maintenance, culvert maintenance, hazard tree removal, management of plantations including gopher control, pre-commercial and commercial thinning, conifer planting and release operations, brush removal, and timber harvest all occur. On private property, there has been homebuilding, maintenance of access roads, and brush removal (hazard reduction). The potential for additional construction of homes on the private in-holdings within the project area is low within the foreseeable future.

Current projects within the Fresno River watershed area include Sonny Meadows North, South and Cedar Valley fuels reduction projects which will have effects to the habitat similar to the proposed project. There are no reasonably foreseeable projects in the watershed that have a proposed action developed so that effects can be predicted. Reasonably foreseeable Forest Service projects, including projects generated by the Healthy Forest Initiative and the National Fire Plan, in the nearby area include continuing vegetation management activities such as fuels

management activities (mastication, pruning, slash disposal, brush removal, fuelbreak maintenance), hazard tree removal, maintenance of roads and culverts and possibly prescribed burning.

Not all areas shown as being covered with 70% or more cover within potential treatment areas will be treated. Steep slopes, Streamside Management Zones, Old Forest Linkages, etc. will not be treated. Habitat will remain the same from the perspective that we are not proposing any treatments in these areas. Only about 2/3 of the mastication treatment areas acreage will actually be treated, if funded. Other portions are either too steep, too rocky; contain too much oak, etc. for treatment. Therefore, some of the areas shown as dense cover within these proposed treatment areas will remain dense cover.

There is a 30-inch diameter limit. In all previous thinnings, pockets of trees too large to remove had to be left that had greater than proposed leave basal area stocking levels. There is no reason to think that the same situation will not occur on this project. Timber marking crews do not always mark trees for removal down to the desired leave basal area. Crews have habitually left more trees than the prescription called for. Minimal to no harvest will be done in archeological sites. Trees within arch sites will generally remain following harvest.

To the south of the Sugar Pine project lies the Progeny Sale Area. This area was thinned several years ago. Crowns are beginning to close back in. Much of the area is shown as 70% or more crown closure. Post sale work (thinning and piling or mastication) is being completed within the next year or two. Suitable denning and nesting habitat should be available in much of this area as treatments are undertaken within Sugar Pine.

The district has been thinning younger stands for the past 12 to 15 years to the same specifications. Since thinning is done from below, suppressed and intermediate trees (those with the poorest crowns) are removed first. If additional trees need to be removed to reach the desired leave basal area, co-dominant trees are then removed until the desired basal area is reached or diameter restrictions require retention of the remaining stems whichever occurs first. Thinning from below generally retains the largest crowned trees. Thinnings have called for a 15 to 20 year reentry period. Experience has shown crowns recapture the sites fairly rapidly. Reproduction pockets growing in openings are planned to be pre-commercially thinned and slash treated. These thinned trees will then be able to maintain good health and vigor. Crown cover, where present, even in more open areas will recover over time.

Plantations will be thinned to maintain good health and vigor. Plantations will be able to more rapidly fill in crown closures by maintaining rapid growth.

Potential Cumulative Effects by Species

Pacific Fisher

The area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on fisher encompasses the Kings River project area, the Sierra NF, and the Southern Sierra Fisher Conservation Area (SSFCA), which is approximately 1,018,000 acres in size. This conservation area is defined by an elevational band from 3,500 to 8,000 feet on the Sierra and Sequoia National Forests and includes the known occupied range of the fisher in the Sierra Nevada (USDA-FS 2001:A-45). This is an appropriate scale for cumulative effects analysis because the SSFCA is an integral component of the conservation strategy described in the 2001 SNFPA ROD (USDA-FS 2001:43). Maintaining the capability for movement and dispersal of fisher between southern Sierra Nevada populations and populations found in northern

California is one of the key objectives of the SSFCA and is another reason why the SSFCA represents an appropriate scale for the analysis of cumulative effects.

Since about the mid 1960s, past activities have included clearcutting and salvage logging (1960s to 1972), sanitation and salvage harvests (1972 through 1978), clearcutting, shelterwood cutting, and salvage harvests (1978 through 1992), and commercial thinning from below and salvage in recent times. The only fires to burn substantial amounts of timber were the Rock Fire in 1981, the Big Creek Fire in 1995 and the North Fork Fire in 2001, with each fire burning about 3000 acres of forest. Clearcuts or burned areas that took place prior to 1972 are most likely successful plantations today exhibiting size class 3 and density class M stands. Other, more recent disturbances, while they may be reforested have probably not yet reached size class 3.

Availability of suitable resting/denning habitat versus foraging habitat

Within the SSFCA, we examined the availability of suitable resting/denning habitat versus foraging habitat. The availability of suitable resting/denning habitat is considered to be more limiting to fisher populations than the availability of foraging habitats (USDA-FS 2006). We used data presented by Freel (1991) to help inform the definitions of resting/denning versus foraging habitat. Also, we validated these habitat definitions by comparing them to CWHR Version 8.1 (CDFG 2005) and discussing them with fisher research scientists (Dr. W. J. Zielinski, Dr. K. Purcell, and R. Truex, pers. comm., 21 Sept 2006). This discussion resulted in the identification of an alternative method for describing fisher reproductive habitat.

In general, we found Freel's (1991) definition for resting and denning habitat matched the CWHR's definition of reproductive habitat. However, we noted that CWHR's definition of foraging habitat included several "S" and "P" densities that were not used by Freel. Interestingly, the discussions with research scientists, particularly Dr. Zielinski, indicated recent field work shows fisher are using most CWHR types for foraging. Nonetheless, we retained the somewhat more restrictive Freel model for the sake of consistency of approach and did not include the S and P densities as foraging habitat. We do not believe this appreciably changes the habitat picture, since foraging habitat is clearly not limiting to fisher. The fisher scientists believe that reproductive habitat is limiting to fisher.

CWHR version 8.1 was used as a basis to define what we consider to be a minimum habitat map, based solely upon forest types, ages, and canopy densities listed therein as HIGH quality reproductive habitat. We further restricted the forest types considered to provide reproductive habitat from those listed in CWHR, based upon personal communication with Dr. Bill Zielinski (21 Sept 2006). This resulted in the elimination of the following types: aspen, eastside pine, lodgepole pine, red fir, and subalpine conifer. This generated a more restrictive map of high quality reproductive habitat.

Past, present, and reasonably foreseeable activities on the Bass Lake Ranger District are described at the beginning of Chapter 3 of the DEIS. The scale for cumulative effects also includes the Sierra National Forest and Sequoia National Forest.

On the Bass Lake Ranger District, there is one present project (Sonny Meadows South – 1,400 or more acres of commercial thinning that will not result in changes to suitable habitat) and two reasonably foreseeable projects (Sonny Meadows North with 955 acres of treatments and Sugar Pine with approximately 915 acres of commercial thinning) that could influence the cumulative effect on fisher habitat. While Sonny Meadows North will not result in any changes in suitable habitat, nor will the Sugar Pine project result in a reduction in quality of suitable habitat on about 816 acres. On the High Sierra District, there is one present project (Jose Basin 1 – 1,263 acres of

commercial thinning) where habitat would be degraded on 60 acres and 8 acres of foraging habitat would be diminished temporarily.

American Marten

The area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on marten encompasses the Sierra NF. This is an appropriate scale for cumulative effects for a wide-ranging species (such as the marten) that has also been selected as a Management Indicator Species for the Sierra NF. Based on the following analysis, a determination of viability for the marten will be made.

In addition to the previously mentioned habitat risk factors, there are two important uncontrollable habitat risk factors for martens: (1) development and (2) climate change. Climate change is beyond the scope of this analysis and areas of large-scale development are not planned for the Sugar Pine project area.

Biological Evaluations for many of the past projects in the Sierra NF were reviewed to help inform the present analysis. Our review of these documents revealed the following basic information about effects to marten from these activities:

- Twenty-six (26) total project Biological Evaluations (BEs) were reviewed, dating back to 1993 on the Sierra NF.
- Determinations reached were:
  - No effect – 7 BEs
  - May affect individual marten, but not likely to lead to a trend toward Federal listing or loss of viability – 15 BEs
  - May affect individual marten, and likely to lead to a trend toward Federal listing or loss of viability – 0 BEs
  - Marten were not addressed in the document we reviewed due to lack of habitat or other reasons – 4 BEs
- Types of projects: Fuels reduction, harvest, hazard tree removal, and thinning were the proposed activities that were most often represented in the sample of BEs in which the marten was analyzed.
- Relative to “May Affect” projects, the described impacts to marten most often fell in the following categories:
  - Temporary disturbances
  - Foraging area may be burned if underburning gets out of control
  - Removed hazard trees could serve as resting or denning sites
  - Habitat altered or removed
  - Reduction of habitat quality (e.g., reduction in canopy cover)
  - Habitat will be entered
  - Noise disturbance (FEIS)

Northern Goshawk

The Northern Goshawk has a continuous distribution throughout the Sierra Nevada with a network of 56 managed territories on the Sierra National Forest. Given the scope and scale of the Sugar Pine project relative to the size of the Sierra Nevada and the goshawk's overall North American distribution, the area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on the Northern Goshawk will focus on the Sierra NF. Based on the following analysis, a determination of viability for the Northern Goshawk will be made.

Biological Evaluations for many of the past projects in the Sierra NF were reviewed to help inform the present analysis. Our review of these documents revealed the following basic information about effects to Northern Goshawks from these activities:

- Twenty-six (26) total project Biological Evaluations (BEs) were reviewed, dating back to 1993 on the Sierra NF.
- Determinations reached were:
  - No effect – 4 BEs
  - May affect individual goshawks, but not likely to lead to a trend toward Federal listing or loss of viability – 20 BEs
  - May affect individual goshawks, and likely to lead to a trend toward Federal listing or loss of viability – 0 BEs
- Northern Goshawk was not addressed in the document we reviewed due to lack of habitat or other reasons – 2 BEs
- Types of projects: Fuels reduction, harvest, hazard tree removal, thinning, and underburning were the proposed activities that were most often represented in the sample of BEs in which the Northern Goshawk was analyzed.
- Relative to "May Affect" projects, the described impacts to Northern Goshawks most often fell in the following categories:
  - Noise disturbances
  - Loss of foraging area if underburn gets out of control
  - Loss of plucking trees
  - Habitat quality reduction

As with other species, the SNFPA (USDA-FS 2001) provided our analysis of Northern Goshawks with useful historical and habitat information. Evidence suggests the low number of goshawk breeding territories (ranging from 12 reported in the SNFPA (USDA-FS 2001) to the 56 such territories known to exist today) has increased since some of the earliest data were reported by Grinnell and Miller (1944 – as cited in USDA-FS 2001), because there has been no apparent change in the geographic distribution of Northern Goshawks in the Sierra Nevada since then. Thus, goshawk numbers in the Sierra NF remain fairly stable. Reasons for this, as put forth by the SNFPA (USDA-FS 2001), include (1) vegetation management practices, (2) the fact that the Sierra NF is near the southernmost edge of the goshawk's range, and (3) survey efforts for goshawks may be lower on the Sierra NF.

The major risk factors identified by the SNFPA (USDA-FS 2001) for goshawks are the effects of vegetation management and wildfires on the amount and distribution of quality habitat.

Unfortunately, goshawk biologists are unsure of what constitutes "high quality" Northern Goshawk habitat in the Sierra Nevada, and as a result, historical patterns of land-use and its effects on goshawks are difficult to interpret. Brian Woodbridge (pers. comm., 8 Sept 2006), however, stated that the 4D CWHR size/density class, and perhaps also 5D, is used most frequently by nesting goshawks. Immediately after the implementation of the Proposed Action, the amount of suitable habitat would not appreciably decrease.

Because the alternatives put forth in this project will result in long-term increases in Northern Goshawk suitable habitat over time, along with the relatively stable geographic distribution and population levels of goshawks in the area, and the project's goal of increasing large diameter trees, the cumulative effects of vegetation management activities in the Sugarpine treatment units taken together with past, present, and reasonably foreseeable activities on the Forest will not result in a loss of viability for the Northern Goshawk." (FEIS)

Great Gray Owl

While this species may move through the project area during winter movements, as there is no suitable breeding habitat within the project area, there are no expected direct or indirect negative effects to these species from the project; therefore, there are no expected cumulative effects from the project.

California Spotted Owl

At a forest-wide scale, there currently are 321 designated Home Range Core Areas and 258 Protected Activity Centers encompassing over 113,000 acres. Over 450,000 acres of suitable habitat currently exist on the Forest. Considering the proposed activities, ongoing actions, and reasonably foreseeable activities, less than one percent of suitable habitat on the Sierra National Forest would be affected.

Since about the mid 1960s, past activities have included clearcutting and salvage logging (1960s to 1972), sanitation and salvage harvests (1972 through 1978), clearcutting, shelterwood cutting, and salvage harvests (1978 through 1992), and commercial thinning from below and salvage in recent times. The only fires to burn substantial amounts of timber were the Rock Fire in 1981, the Big Creek Fire in 1995 and the North Fork Fire in 2001, with each fire burning about 3000 acres of forest. Clearcuts or burned areas that took place prior to 1972 are most likely successful plantations today exhibiting size class 3 and density class M stands. Other, more recent disturbances, while they may be reforested have probably not yet reached size class 3.

In its 12-month finding in which it decided to not list the California Spotted Owl as threatened or endangered, the U.S. Fish and Wildlife Service (USFWS) concluded that the scale, magnitude, or intensity of effects on the California Spotted Owl resulting from fire, fuels treatments, timber harvest, and other activities did not rise above the threshold necessitating protection of the species under the Endangered Species Act (USFWS 2006). The USFWS reached this conclusion after considering the impacts of the Forest Service implementation of the SNFPA ROD. The USFWS conclusion (2006) is supported by:

- Data which indicate that California Spotted Owl populations in the Sierra Nevada are stable and comprise 81% of the species' known territories.
- The anticipation that current and planned fuels-reduction activities throughout the range of the species will have a long-term benefit by reducing the risk of stand replacing wildfire; these activities embrace those described by the SNFPA ROD.

- Barred Owls represent only about 2% of California Spotted Owl habitat in the Sierra Nevada.
- Protection measures are being implemented for the California Spotted Owl on private lands, including the largest private landholders within the range of the species (FEIS).

Pallid Bat

The area considered in determining the cumulative effects of past, present, and reasonably foreseeable activities on pallid bats encompasses the Sierra NF. Based on the following analysis, a determination of viability for the bat will be made.

Biological Evaluations for many of the past projects in the Sierra NF were reviewed to help inform the present analysis. Our review of these documents revealed the following basic information about effects to pallid bats from these activities:

- Twenty-six (26) total project Biological Evaluations (BEs) were reviewed, dating back to 1993 on the Sierra NF. The species was not listed as Forest Service sensitive until the updated list from June 1998.
- Determinations reached were:
  - No effect – 4 BEs
  - May affect individual bats, but not likely to lead to a trend toward Federal listing or loss of viability – 10 BEs
  - May affect individual bats, and likely to lead to a trend toward Federal listing or loss of viability – 0 BEs
  - Pallid bat was not addressed in the document we reviewed due to lack of habitat or other reasons – 12 BEs
- Types of projects: Fuels reduction, hazard tree removal, thinning, and underburning were the proposed activities that were most often represented in the sample of BEs in which the pallid bat was analyzed.
- Relative to “May Affect” projects, the described impacts to pallid bats most often fell in the following categories:
  - Loss of roosting trees/snags
  - Displacement because of smoke from underburning
  - Noise disturbance

Pallid bats occur most frequently below 6,000 feet and are especially sensitive to the removal of hardwoods (USDA-FS 2001). Except for 4D and 5D, CWHR rates all size classes and densities in blue oak woodlands as High for pallid bat, in terms of meeting its foraging needs. Montane hardwood conifer and montane hardwood habitats are rated Low for pallid bat by CWHR (CDFG 2005). Currently, there are 32,600 acres of blue oak woodlands and 251,000 acres of montane hardwoods and montane hardwood conifers below 8,000 ft on the Sierra NF in CWHR size classes 2 and higher. The protection, maintenance, and enhancement of such westside foothill oaks and montane oaks are expected to benefit pallid bats by ensuring the continued availability of roosting sites. Indeed, all alternatives proposed in the SNFPA would lead to an increase in oak species (USDA-FS 2001).

Cumulative effects discussed in the SNFPA stated that there have been no recent changes in the range or distribution of the pallid bat (USDA-FS 2001). For these reasons, and given the long-term objective for increasing the number of large trees across the landscape, the intention of reducing fuels, and the foregoing discussion of effects, the cumulative effects of vegetation management activities in the Sugar Pine treatment areas taken together with past, present, and reasonably foreseeable activities on the Forest will not result in a loss of viability for the pallid bat.

Townsend's Big-eared and Western Red Bat

There are no expected direct or indirect negative effects to these species from the project; therefore, there are no expected cumulative effects from the project.

Alternative 3

This alternative leads to a lower level of removal of larger trees within the project treatment units. Those areas that are within current fisher den site buffer will be treated for surface and ladder fuels only. For a detailed description of those fuels to be removed, please see the Fuels Treatment portion of the DEIS. While no currently designated habitat (PPN, SMC, MHC and RFR, 4D and 5D types) are intended to be reduced below those designations, understory and some co-dominates will be removed. Those 4D and 5D habitat types have been identified as being the most important to old growth species such as California spotted owls, northern goshawks or Pacific fisher for denning, resting and breeding habitat. None of those habitats will be reduced to less than their current designation. This alternative will lead to highest growth rates of retained trees outside of the fisher den site buffer, stems, leading to old growth characteristics the fastest and reduce potential mortality from drought stress and subsequent beetle and disease mortality. Those retained stems within the den site buffer will receive some small relief from the removal of fuel ladders but not to the extent of those trees outside of the buffer area.

Direct Effects

The most probable direct effect to species will be a noise disturbance effect, potentially leading to an energetic response in avoiding project activities. There would be no appreciable difference in the direct effects inside or out of the den site buffer. No direct mortality from project activities would be expected as complete surveys of old forest TES species will be completed prior to project activities occurring and those locations and an appropriate perimeter around them would be avoided until after the appropriate Limited Operating Periods are completed. With respect to the Pallid bat, which is known to use sloughing bark of large snags, every effort would be made to avoid damaging or removing those snags.

Indirect Effects

Maintenance of the highest areas of biodiversity Old Forest Linkages (OFL), and oak understory characters as well as large tree groups will provide cover for species of concern and their prey. It is poorly understood as to the rate of recovery of those areas that are manipulated, whether they will be immediately begin to be reused or whether there will be some lag time. That is one of the questions we are attempting to address with the Universities Sierra Nevada Adaptive Management Study; however, it is expected that without some form of density management of the stands, eventual higher levels of mortality and reduced growth rates within those stands will occur. With respect to stand replacing wildfire events this alternative provides the highest level of protection possible without diminishing the ability of those stands to support species of concern and their prey.

Cumulative Effects

The Cumulative Effects for Alternative 3 will be identical to those for Alternative 2 with the exception of a lower canopy treatment with limited mid-level canopy treatment within the current fisher den site buffer area.

Alternative 4

This alternative leads to no removal of large trees within the project treatment units. The project area will be treated for surface and ladder fuels only. For a detailed description of those fuels to be removed, please see the Fuels Treatment portion of the DEIS. No currently designated habitat (PPN, SMC, MHC and RFR, 4D and 5D types) are to be reduced below those designations, understory and ladder fuels only will be removed. This action alternative will lead to the lowest growth rate leading to old growth characteristics within the project area and a higher potential mortality from drought stress and subsequent beetle and disease mortality.

Direct Effects

The most probable direct effect to species will be a noise disturbance effect, potentially leading to an energetic response in avoiding project activities. There will be no change CWHR type across the project with the exception of prescribed burn areas which occasionally see small torching of trees resulting in small canopy losses, typically less than 1 acre in size. No direct mortality from project activities would be expected as complete surveys of old forest TES species will be completed prior to project activities occurring and those locations and an appropriate perimeter around them would be avoided until after the appropriate Limited Operating Periods are completed. With respect to the Pallid bat, which is known to use sloughing bark of large snags, every effort would be made to avoid damaging or removing those snags by lining them out within the prescribed burn areas.

Indirect Effects

Maintenance of the highest areas of biodiversity Old Forest Linkages (OFL), and oak understory characters as well as large tree groups will provide cover for species of concern and their prey. It is poorly understood as to the rate of recovery of those areas that are manipulated, whether they will be immediately begin to be reused or whether there will be some lag time. That is one of the questions we are attempting to address with the Universities Sierra Nevada Adaptive Management Study; however, it is expected that without some form of density management of the stands, eventual higher levels of mortality and reduced growth rates within those stands will occur. With respect to stand replacing wildfire events this alternative provides the highest level of protection possible without diminishing the ability of those stands to support species of concern and their prey.

Cumulative Effects

The cumulative effects of Alternative 4 will consist of only treating lower canopy and moderate mid level fuels.

Aquatic Wildlife and Management Indicator Species

Affected Environment

The Sugar Pine Adaptive Management Project drains to two watersheds, Lewis Creek and Big Creek, comprised of two 6th code Hydrologic Units (HUC6s). Lewis Creek is tributary to the Fresno River, and Big Creek flows directly into the Merced River. Each of these basins is further divided into HUC7s and HUC8s. Analysis was conducted at the HUC8 scale, which ranges from 466 to 2,564 acres in the project area. For this analysis, the term 'subwatershed' is used to refer to these HUC 8s. The Analysis Area is the 12 HUC8 subwatersheds that include the treatment areas proposed under the Sugar Pine Project. Table 9 indicates stream drainage and flow regime within the aquatic analysis area based on Geographic Information Systems (GIS).

Table 9. Watershed Summaries by Stream Classification

Main Stream System(s)	Watershed (HUC 5)	Sub-watersheds (HUC 8)	Stream Miles			
			Perennial	Intermittent	Ephemeral	Total
Lewis Creek	Fresno River (1804000701)	503.0008 503.0009 503.0010 503.0011 503.0055 503.3001	16.6	11.5	112.2	140.3
Big Creek	SF Merced (1804000803)	501.5003 501.5005 501.5006 501.5007 501.5053 501.5054	17.1	13.5	90.5	121.1

The project area drainage is considered part of the Sacramento-San Joaquin zoogeographic province as described by Moyle (1976, 2002). It is not known whether salmonids are native to the two watersheds within the project boundaries. Moyle (et al. 1996, 2002) identifies much of the west slope of the Sierra Nevada range above 5,000 feet elevation as being historically fishless due to glaciation during the Pleistocene and steep topography. The fish community for the project area elevation and zoogeographic province is described by Moyle (2002) as the rainbow trout (*Oncorhynchus mykiss*) assemblage. That species is found in clear high-gradient, perennial streams at high elevations. Such habitats are characterized as having more riffle than pools, with water temperatures seldom exceeding 21 degrees Celsius (º C).

Between 1991 and 2007, primary streams and meadows were surveyed over various times and locations. Surveys have been conducted for aquatic species, stream channel characteristics, and

watershed restoration needs. Channels were defined by reach type based on observed channel gradient, width/depth ratios, channel meander, substrate material, channel stability (Pfankuch 1975), riparian zone, large woody debris and fish habitat. Channel reach types (Rosgen 1996) were determined based on observed channel attributes such as channel morphology, along with sediment and transport characteristics. Channel types are evaluated in terms of sensitivity to disturbance as presented by Rosgen (1996), which varies by channel gradient and size of substrate. Five Stream Condition Inventory (SCI) (USDA-Forest Service 2005a) plots were established along possible response or depositional channels (Montgomery and Buffington 1997) (low gradient, fine substrate) to evaluate current conditions and establish a possible baseline comparison for future monitoring. Benthic macroinvertebrates were evaluated using biotic indices from Hilsenhoff (1987) and Winget et al. (1979). Separate surveys for reptiles and amphibians (Fellers and Freel 1995) were completed in 2007.

Surveys within the aquatic analysis area have identified that rainbow and brown trout occur in all the larger perennial tributaries within the project area. These two species are collectively referred to as resident trout. Upstream fish movements are limited by areas of high channel gradient, falls, and several small dams (private property). A put-and-take fishery is maintained by the California Department of Fish and Game (CDFG) within the project area, although streams are self-sustaining. Both Lewis and Big Creek are subject to angling pressure. There are 34 miles of perennial streams occurring in the project area subwatersheds. The perennial streams are potentially habitat for resident trout, aquatic macroinvertebrates, and herpetofauna, although intermittent and ephemeral channels can serve as migration corridors for herpetofauna and also influence habitat in the perennial streams. Map 9 located in the Appendix A, Map Package, displays the perennial stream systems and subwatersheds for the Sugar Pine Adaptive Management Project area.

A number of special interest amphibian or reptile (herpetofauna) species may occur or have suitable habitat in the project area subwatersheds. The U.S. Fish and Wildlife Service (USFWS 2009) indicated that potential habitat may be present for the threatened, endangered, or candidate species: California red-legged frog (*Rana aurora draytonii*); mountain yellow-legged frog (*R. muscosa*); and Yosemite toad (*Bufo canorus*). Additionally, suitable habitat may be present for the Forest Service sensitive western pond turtle (*Clemmys marmorata*) and foothill yellow-legged frog (*R. boylii*). Potentially suitable habitat for these species would be perennial streams, meadows, and ponds. Additionally, foothill yellow-legged frog and western pond turtle may also utilize intermittent streams. Elevations less than 5000 feet may provide habitat for California red-legged frog, foothill yellow-legged frog, or western pond turtle. Elevations greater than 5000 feet may provide habitat for mountain yellow-legged frog, and meadows at elevations greater than 6000 feet could provide Yosemite toad habitat.

Existing Condition Summaries

The following tables and figures summarize information within project area HUC8 subwatersheds. Information is summarized from the Project Hydrology, Aquatics, Aquatic Species Biological Assessment/Evaluation, and Management Indicator Species reports. Table 10 indicates present stream channel conditions and overall sensitivity to disturbance.

Table 10. Summary of Subwatershed Conditions

Subwatershed	Acres	Current Channel Stability	Sensitivity to disturbance
501.5003	466	Stable	Low
501.5005	2229	Stable	Moderate
501.5006	638	Stable	Moderate
501.5007	668	Stable	Moderate
501.5053	1817	Stable	Low
501.5054	1480	Stable	Low
503.0008	945	Stable	Moderate
503.0009	2010	Stable	High
503.0010	1549	Stable	High
503.0011	645	Stable	Moderate
503.0055	2564	Stable	Low
503.3001	1381	Stable	Moderate

Table 11 displays miles of perennial streams, miles occuppied by resident trout, 2007 maximum (15-minute) summer water temperatures from the larger perennial streams, stream shading, and results from benthic macroinvertebrate sampling expressed as Hilsenhoff Biotic Index (HBI), and Biotic Condition Index (BCI) (Vinson 2008). Table 12 presents woody debris data from the project SCI plots and stream channel surveys, while Table 13 notes potential habitat for threatened, endangered, proposed or sensitive (TEPS) herpetofauna, along with Aquatic Management Indicator Species (MIS). Figure 2 displays mean daily water temperatures through the summer of 2007.

Table 11. Perennial Streams; Resident Trout Occupancy, Maximum 15-Minute Water Temperatures, Percent Stream Shading, and Indices for Benthic Macroinvertebrates

Subwatershed	Perennial (mi)	Resident Trout occupied (mi)	Max Water Temp (ºC)	Stream Shading	HB Index	BCI
501.5003	1.1	0.5	13.3	>70%	ND	ND
501.5005	4.2	3.0	ND	ND	4.14	140
501.5006	1.6	1.2	19.2	70%	4.09	85
501.5007	1.1	0.3	ND	ND	ND	ND
501.5053	4.8	4.8	19.4	70%	4.13	86
501.5054	4.3	4.3	ND	ND	ND	ND
503.0008	1.5	0.2	ND	70%	ND	ND
503.0009	3.7	3	ND	70%	ND	ND
503.0010	2.4	1.7	17	78%	4.14	82
503.0011	1.2	0	ND	84%	4.60	119
503.0055	5.4	5.4	18.3	70%	3.14	100
503.3001	2.4	1.8	ND	ND	ND	ND

(ND= No SCI data)

Table 12. Woody Debris Data

Subwatershed	Min length (m)	Mean density/100 m (d >=0.1 m)	LWD/100 m (0.3 x 3 m)
501.5003	ND	ND	ND
501.5005	ND	ND	ND
501.5006	1.1	110	7
501.5007	ND	ND	ND
501.5053	7.7	22.3	1.4
501.0054	ND	ND	ND
503.0008	3	ND	5.3
503.0009	3	ND	8.9
503.0010	1.4	167	2
503.0011	0.9	135	0.7
503.0055	3.6	140	2.5
503.3001	ND	ND	11.1

(ND= No SCI or stream survey data)

Table 13. Summary of Potential Habitat within Project Area Subwatersheds (Potential Acres Includes Marginal Acres)

Note: foothill yellow-legged frog acres are within western pond turtle habitat (overlap).

Species	Potential Habitat (ac)	Marginal (ac)
California red-legged frog	5	0
Foothill yellow-legged frog	900	590
Western pond turtle	1740	1150
Mountain yellow-legged frog	670	330
Yosemite toad	110	0
Benthic macroinverbrates	34 (mi)	0
Pacific tree frog	172	0

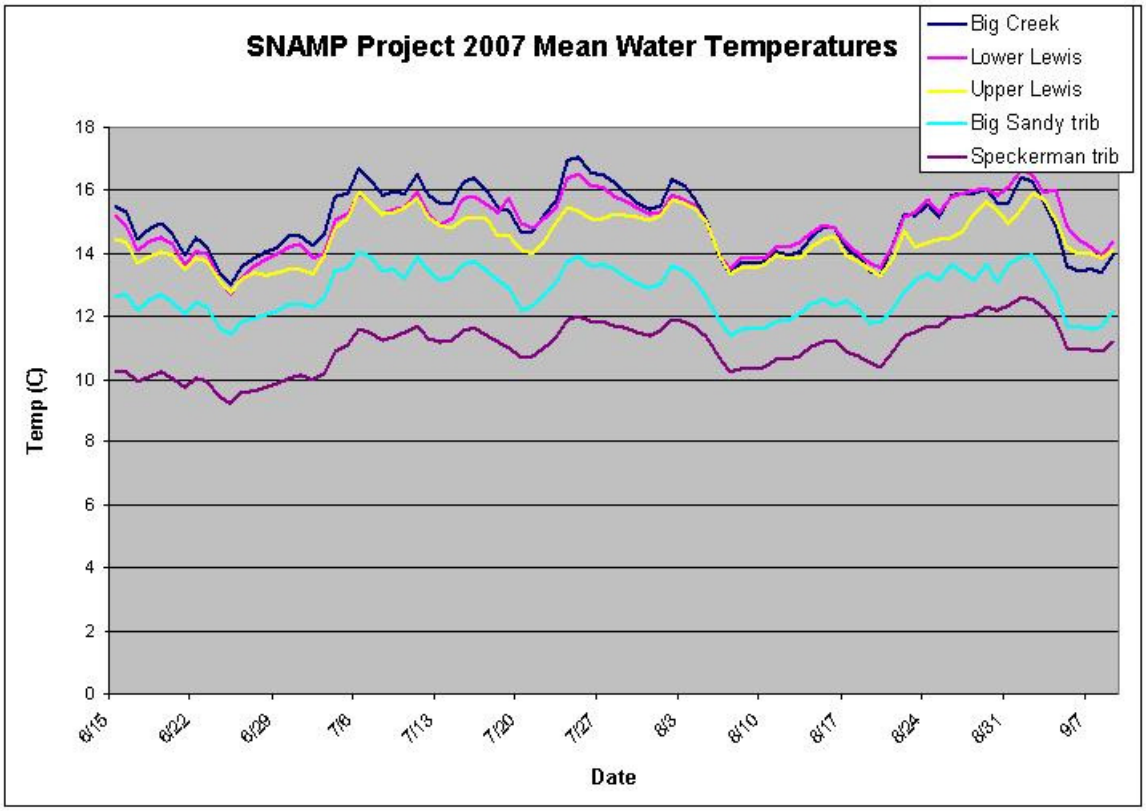

Figure 2. 2007 average summer water temperatures for project area streams

Environmental Consequences

This section analyzes the effects of the Sugar Pine Adaptive Management Project on aquatic/riparian species and their habitats. A list of past, present, and foreseeable projects for the project area is located in Chapter 3. Proposed management actions have the potential to directly alter stream shading (solar radiation); and indirectly or cumulatively alter water temperature; water quantity; water quality; sediment, nutrient, and litter inputs; woody debris; and channel structure. All of these elements can affect aquatic habitat and nutritional resources of aquatic organisms (Gregory et al. 1987; Chamberlin et al. 1991; Furniss et al. 1991; Dwire et al. 2006).

Aquatic (benthic) macroinvertebrates (a Management Indicator Species or MIS) are recognized for their importance in the aquatic/riparian systems within the project area. Thus, if the project alters stream temperature, canopy cover, hydrologic regime, sediment inputs, seeps/springs/headwater areas, and nutrient cycling (LWD or litter inputs), it could affect aquatic/riparian species indirectly through affects to the invertebrate community. Various life stages of resident trout and herpetofauna utilize benthic macroinvertebrates as a food source.

Stream flow may increase as basal area (and evapotranspiration) declines, and peak flows can be indirectly affected by vegetation removal (Chamberlin et al. 1991; Kattleman 1996). Troendle (2001) indicated increased water yields following timber harvest, although treatments were primarily clearcuts rather than thinnings that are being proposed for the Sugar Pine project. Alteration of the hydrologic regime (timing, duration or magnitude of flows) from the combined effects of silviculture and underburning could affect spawning for fish, amphibian breeding, and MIS habitat (benthic macroinvertebrates and Pacific tree frog). Such an alteration could also result in channel downcutting, bank instabilities and degradation of aquatic habitat through additional accumulations of sediment in pool habitat and covering of spawning gravels. In snow-dominated areas, such as the Sugar Pine drainage area, nearly all of the change in flows would occur during spring runoff, and spring runoff may occur slightly sooner if reductions in canopy allow faster melting of the snowpack.

Fire Effects

One of the objectives of the Sugar Pine Adaptive Management Project is to modify the intensity and spread of fire in the Wildland Urban Interface near the communities of Sugar Pine and Fish Camp. This would be accomplished using a combination of thinning and fuels reduction. Nakamura et al. (2008) noted some success with reducing crown fire after thinning and burning for the Cone and Megram Fires. They also note that some fires are so large (McNally or Cedar Fires) that would likely continue to burn through or around treatment areas.

Little is known about fire history of riparian areas in the west, but it is expected to vary from those experienced in upland areas (Dwire and Kauffman 2003; Bisson et al. 2003). Riparian areas differ from upland areas in topography, microclimate, geomorphology, and vegetation. Further they are characterized as having cooler air temperatures, lower daily maximum air temperatures, and higher relative humidity. These characteristics may contribute to higher moisture content of live and dead fuels, and riparian soils, which presumably lowers the intensity, severity and frequency of fire (Dwire and Kauffman 2003).

Fire, both prescribed and wild, has potential to affect aquatic/riparian systems. Prescribed burning could indirectly affect streambank stability, aquatic foodwebs, stream temperature, and large wood dynamics (Dwire et al. 2006; Bêche et al. 2005). High intensity fires can severely disrupt aquatic ecosystems, and that these affects can be prolonged (up to 300 years for LWD). Specific influences may include decreased channel stability; greater and more variable stream discharge;

altered woody debris delivery and storage; increased nutrient availability; higher sediment delivery and transport; and increased solar radiation and altered water temperature regime (Bisson et al. 2003; Dunham et al. 2003).

Impact of fire on the benthic macroinvertebrate community varies by burn intensity and extent; steam size and gradient; precipitation and amount of runoff; vegetative cover; geology; and topography. Some indicators of community health may return to pre-fire conditions within 1 to 2 years, but the overall community will probably vary for 5 to 10 years after the fire (Minshall 2003; Reardon et al. 2005).

The extent of fire effects on fish populations would be related to recovery of suitable water temperatures, suitable water quality, and connectivity to population refugia. Trout are noted as being resilient and adapted to disturbance (Rieman and Clayton 1997; Dunham et al. 2003; Rinne and Jacoby 2005), but recovery could take a decade or more. Sestrich (2005) reported that native trout populations recovered rapidly, with some sites exceeding pre-fire population levels within three years following fires in the Bitterroot River Basin (2000). Greswell (1999) considered the disturbance regime resulting from wildfire could facilitate invasion by nonnative fish species.

The ecological diversity of riparian corridors is maintained by natural disturbance regimes including fire and fire-related flooding, debris flows, and landslides (Dwire and Kauffman 2003). Many species have adapted life histories that are shaped by, and may depend on disturbance events (Dunham et al. 2003; Bisson et al. 2003; Rieman et al. 2005). There remains debate among Aquatic Ecologists regarding the need to treat riparian areas, and the types of treatments. Part of the controversy is related to the diverse and complex effects that fire can have on aquatic systems (Dunham et al. 2003). Researchers agree that aquatic systems have developed under a disturbance regime. Some aquatic biologists believe that wildfire poses additional risk to endangered species, while others feel affects from treatments are more likely to damage aquatic systems than fire (Erman 1996; Bisson et al. 2003). Analysis following the Angora Fire (USDA-FS 2007), identified fire spread was facilitated in part by corridors provided in the no-treatment Streamside Environmental Zones.

Desired Conditions

Desired conditions for the project area were described in the Fresno River Landscape Analysis (USDA-FS 2005a). Indicators are measures that can be used to describe the condition of aquatic/riparian ecosystems. They represent elements that might change as a result of management activities. There are two riparian vegetation indicators identified in the Landscape Analysis; canopy cover and large woody debris. While not identified in the Fresno River Landscape Analysis, water temperature will also be used as an aquatic indicator. The Sierra Nevada Ecosystem Project (SNEP) (Jennings 1996; Moyle et al. 1996; Erman 1996) notes that these aquatic indicators could be potentially be affected by the types of activities being proposed. The aquatic indicators are described in the following:

Canopy Cover

Canopy cover is the degree to which tree canopies obscure the sky or block the sun. Canopy cover was measured as the percentage of stream shading and varies by the width of the stream channel, which is generally a function of stream order. Stream shading is important in maintaining water temperature with the effect varying by the height of adjacent vegetation, proximity to the stream, topography, angle of the sun, and aspect (Beschta et al. 1987; USGS 1997, 2002; Moore et al. 2005). The Fresno River Landscape Analysis (USDA Forest Service 2005a) identifies stream shading of 70 to 80% within the riparian zone as a desired condition.

Large Woody Debris

Large woody debris (LWD) is of both physical and biological importance within stream channels and riparian zones (Bisson et al. 1987; Sedell et al. 1988). LWD provide sediment traps, affect stream channel morphology to create pool habitat, increase channel roughness to dissipate energy, provide complexity to habitat, provide structural cover, and provide nutrient inputs (Bisson et al. 1987). LWD provide cover for fish and animal species, are directly consumed by specialized macroinvertebrates. Factors influencing LWD in the Sierra Nevada mountain range may include geomorphology, decay resistance of local species, floods and past management (Ruediger and Ward 1996). The desired condition from the Fresno River Landscape Analysis is that project streams should average (over the watershed) between 3 to 15 LWD/100 m of the larger (stable) class.

Water Temperature

Water temperature has multiple effects on aquatic/riparian species and their behavior. Thermal effects relate to directing behavior (trigger migration or spawning); controlling factors (time of incubation and emergence); lethal (lead to breakdown of homeostatic system and increased susceptibility to disease); and growth (metabolic regulation; affected by food supply) (Beschta et al. 1987; Armour 1988; USGS 1997; 2002; Sauter et al. 2001). Elevation, aspect, stream width, channel roughness coefficient, riparian shading, solar radiation, air temperature, cloud cover, and stream discharge levels can affect water temperature. Of these elements, direct effects on riparian shading and indirect effects on stream discharge level could have the most effect on stream temperature (Beschta et al. 1987; Moore et al. 2005). A desired condition for water temperature was not identified in the Fresno River Landscape Analysis. The CDFG discontinues trout stocking if water temperatures exceed 21° C (CDFG 2009), thus the Desired Condition for this analysis is that water temperatures be less than 21° C. This temperature is also consistent with that described by Moyle (1976; 2002) within the rainbow trout assemblage.

Alternative 1 – No Action

Under the No Action alternative, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences. No treatments would be implemented in any subwatershed as displayed in Table 14.

Table 14. Sugar Pine Adaptive Management Activities Proposed under Alternative 1 by Subwatershed

Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.001	503.0011	503.0055	503.3001	Total
Commercial or pre-commercial thinning or tractor piling	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Precommercial Thin	0	0	0	0	0	0	0	0	0	0	0	0	
Mastication	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Underburn	0	0	0	0	0	0	0	0	0	0	0	0	**0**
No Treatments	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**

The No Action Alternative would not implement the Sugar Pine Adaptive Management Project to reduce fire ladder conditions or stand densities (thinning); pile slash for burning; burn slash piles; masticate and/and or precommercially thin stands; plant trees; reduce fuel loading through controlled burning; construct handline around jackpot burn areas; manually remove noxious weeds, or construct and reconstruct roads. Potentially affected habitat for aquatic threatened, endangered, sensitive and MIS species is displayed in Table 15. Indicators for aquatic/riparian habitat and species are canopy cover, water temperature, and large woody debris.

Direct Effects

Canopy Cover

No commercial timber removal or underburning would occur under this alternative. No direct, indirect, or cumulative affects to riparian canopy cover (current stream shading > 70%) are anticipated from Alternative 1. There would be no direct effects on TES aquatic species or their habitat. Stream shading would meet the desired condition of > 70 to 80%.

Water Temperature

There would be no anticipated direct effect on water temperature as a result of the Alternative 1.

Large Woody Debris

There are no activities proposed under Alternative 1. There would be no direct effects on LWD recruitment.

Indirect Effects

Canopy Cover

No indirect effects on canopy cover from stand density alteration or fuel treatment would occur under Alternative 1. Pilliod et al. (2003) suggest that no action may have consequences for amphibians due to overgrown forests changing the quality of amphibian habitat and increasing susceptibility for a high severity fire.

Water Temperature

Water temperature data collected from the project area in 2007 indicate project area streams are within the desired condition and within the range for resident trout species.

It is anticipated that Alternative 1 would maintain water temperatures within the desired condition (< 21° C) and no indirect affects would be anticipated.

Indirect and Cumulative Effects on Large Woody Debris

There are no anticipated indirect or cumulative effects on LWD from the No Action Alternative. LWD would remain lower than desired within subwatersheds 501.5053, 503.0010, 503.0011, and 503.0055. Several other subwatersheds have no LWD data and may also be less than desired.

Cumulative Effects

Past, present, and reasonably foreseeable actions within the project areas are displayed in Chapter 3 on page 25. Under Alternative 1, the Sugar Pine Project would not be implemented. Within the project area, other known activities are off-highway vehicle use, fuels, culture, and timber projects (past Federal and activities on private property), cattle grazing, road and road maintenance, and recreational use (both developed and undeveloped). Of the actions evaluated

within the analysis area, timber harvesting on private land and cattle grazing have the greatest potential to alter aquatic habitat.

Timber harvesting on private land requires a Timber Harvest Plan (THP) that evaluates compliance with State and Federal rules and laws (CDF 2005). The THP includes a cumulative effects analysis that considers effects on water temperatures, stream shading, and measures to reduce sediment movement. Most of the Forest Service actions over the past decade, along with those proposed in the next decade, relate to fuels reduction or forest thinning. These actions have Best Management Practices (BMPs) (USDA-FS 1983, 2002), along with Forest standards and guidelines to restrict off-site erosion and activities within Streamside Management Zones (SMZs). Stream channels would be expected to remain stable, with some sites of localized instability. LWD would remain below desired in subwatersheds 501.0053, 503.0010, 503.0011, and 503.0055. Approximately 0.8 miles of road cross wet meadows, representing impacts to roughly 2 acres (18 foot road template) of wet meadow habitat

The project area is primarily within the Soquel grazing allotment. Most of the primary and secondary grazing areas occur in subwatersheds 501.5005, 501.5006, and 501.5007. Proper Functioning Condition (USDI-BLM 1995) was conducted at Boggy and Soquel Meadows within the allotment in 2007. Both sites were at Properly Functioning Condition. It is expected that cattle grazing will locally result in exposed streambanks and erosion.

The Cumulative Watershed Effects Analysis (CWEA) prepared for this project (Gallegos 2009) includes consideration of actions on private lands in addition to Forest Service permitted actions. The Project CWEA does not indicate that a cumulative effect to watersheds would be expected from Alternative 1. However, it does note that subwatersheds 501.5053 and 503.0055 would remain above the lower bound threshold of concern (TOC). The bounds are guidelines developed to indicate risk of cumulative effects, and to identify areas for field review. The stream channel within subwatershed 503.0055 is the main stem of Lewis Creek. The creek through this subwatershed is primarily high gradient, with a bedrock and boulder substrate, thus has limited probability of stream channel instabilities developing. Observations of the water temperatures were recorded from Lewis Creek (within subwatershed 503.0055) during the summer of 2007. Water temperatures never exceeded 18.3° C (15 minute step) or had a daily average greater than 16.6° C. It does not appear that current upstream uses are negatively affecting conditions within the subwatershed. Benthic macroinvertebrate sample data indicates water quality presently is in good condition within this subwatershed.

Table 15. Summary from analyses for aquatic Threatened (T), Endangered (E), Sensitive (S) and Management Indicator Species (MIS) for effects from Alternative 1

Species (status)	Potential Habitat (ac)	Marginal (ac)	Potential Habitat in Treatment Area (ac)	Marginal Habitat in Treatment Area (ac)	Determination
California red-legged frog (T)	5	0	0	0	No effect
Foothill yellow-legged frog (S)	900	590	0	0	No effect
Western pond turtle (S)	1740	1150	0	0	No effect
Mountain yellow-legged frog (S)	670	330	0	0	No effect
Yosemite toad (S)	110	0	0	0	No effect
Benthic macroinvertebrate habitat (MIS)	34 mi.	0	0	0	Stable
Pacific tree frog habitat (MIS)	170	0	0	0	Stable

Source: Strand 2009, Strand 2009a

Alternative 2 – Proposed Action

Under Alternative 2, the development of Strategically Placed Area Treatments (SPLATs) would occur. Additional areas would be treated to provide a defensible fuels profile near key transportation corridors and within the defense zone of the wildland urban intermix. In addition to those treatments needed to meet fire and fuels objectives treatments would be created to reduce stand densities (basal area) to such a level as to improve the growth and vigor of remaining trees. Treatments included in this alternative are: thinning from below in conifer stands, either pre-commercially, commercially, biomassing and/or mastication to reduce lower and mid-level canopy stand densities; mastication of brush and shrub patches; prescribed burning, both understory and piles; manual reduction and/or prescribed burning of noxious weed infestations; and prepare and plant failed conifer plantations. Proposed treatments by subwatershed are displayed in Table 16.

Table 17 displays herpetofauna and MIS habitat potentially affected by the Proposed Action.

Table 16. Activities Proposed within Project Area Subwatersheds under Alternative 2

Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.0010	503.0011	503.0055	503.3001	Total
Commercial/pre-commercial thinning or tractor piling	0	5	194	132	124	11	297	323	627	33	162		**1908**
Mastication	19	8	79	0	34	18	110	294	3	139	80	14	**797**
Underburn	0	9	15	0	21	22	15	113	22	0	0		**215**
No Treatments	447	2207	352	536	1638	1429	524	1280	897	473	2322	1367	**13472**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
% Subwatershed treated	4%	1%	45%	20%	10%	4%	45%	35%	42%	27%	9%	1%	**18%**

Table 17. Overlap of Proposed Treatment Areas and Potential Habitat for species

CRLF acreage represent suitable breeding habitat (most acres evaluated under the site assessment did not represent suitable breeding during site review.) RABO acres are within WPT habitat (overlap). Marginal acres are included in Potential Habitat acres. No treatment zones are core areas along perennial streams (50 ft) and intermittent streams (25 ft) that would have no activity.

Species	Potential Habitat (ac)	Marginal (ac)	Potential Habitat in Treatment Area (ac)	Marginal Habitat in Treatment Area (ac)	No Treatment Zones (ac)
California red-legged frog (CRLF)	5	0	0	0	0
Foothill yellow-legged frog (RABO)	900	590	320	230	90
Western pond turtle (WPT)	1740	1150	630	440	90
Mountain yellow-legged frog (RAMU)	670	330	90	50	28
Yosemite toad (BUCA)	110	0	30	0	2
Benthic Macroinvertebrates (MIS)	34 mi	0	8 mi	0	8 mi
Pacific tree frog (MIS)	170	0	7 ac	0	7 ac

Commercial or pre-commercial thinning, along with tractor piling, would occur over 1900 acres (gross treatment area) under the Proposed Action. The actual area treated would be less considering SMZs, Old Forest Linkage corridors, controlled areas, aggregations within treatment areas not requiring treatment to achieve project objectives, and access limitations due to topography. Commercial thinning would occur over approximately 850 acres under the Proposed Action. Underburning is proposed over approximately 215 acres (<2 % of the project area). Within the 34 miles of perennial stream channel, approximately 7.6 miles are either within or bordered by a proposed treatment unit. Additionally, approximately 7 acres of wet meadow are within or adjacent to proposed treatment units. Project implementation would incorporate Best Management Practices (BMPs). BMPs (USDA-Forest Service 1983; 2002) were developed to reduce erosion and off-site transport of sediment to stream channels. BMPs implemented with this project are detailed under Project Design Criteria and were identified in the project Hydrology Report (Kaplan-Henry and Stone 2008). Literature indicates that BMPs are effective in minimizing the erosion in harvest units and at preventing sediment from reaching streams. In a study of sediment redistribution after harvesting, Wallbrink and Croke (2002) found that sediment eroded from skid trails was deposited in the harvest unit and the 23 to 30 m wide stream buffers. MacDonald and Stednick (2003) note that forest harvest and fuels treatments should have little effect on water quality if they are well-planned and BMPs are implemented. Monitoring of BMP on Forest Service lands in California has shown that, when implemented, timber management BMP are 95 to 98% effective (USDA-FS 2004a).

Aquatic habitat indicators are canopy cover, water temperature, and large woody debris.

Direct Effects

The 5 acres of potential habitat for California red-legged frog are the private ponds in the Sugar Pine and Fish Camp areas, which are not part of this project. Potential effects on foothill yellow-legged frog (RABO), western pond turtle (WPT), mountain yellow-legged frog (RAMU), or Yosemite toad (BUCA) could occur from crushing of individual animals by tractor thinning, tractor piling, or mastication, or from burning of animals. Most direct effects would not be expected to occur due herpetofauna primarily occupying riparian areas where proposed treatments are limited. During primary periods of project operations (May through Sept) it is expected that frogs and turtles would remain within the riparian areas due to presence of water, the microclimate provided, and riparian connectivity, except during rainy periods. The possibility of direct effects from crushing would be most likely in October when species leave streamside areas for overwintering sites or during rainy periods when species may move beyond riparian areas. Operation of heavy equipment ceases during periods of prolonged precipitation to prevent compaction.

Introduced fire could directly affect herpetofauna. Some species may use slash piles for cover or for estivation. The possibility of direct effects on individual animals from burning piles within the Old Forest Linkage Corridors would be reduced by implementing the project design measure to light piles on one side to allow an escape from the pile. Underburning may also represent a direct effect to herpetofauna. Underburning is proposed adjacent to perennial streams in units RX 1, 3, and 5. RX units 3 and 5 represent approximately 7 acres of RABO and 13 acres of WPT habitat. RX 3 contains approximately 5 acres of RAMU habitat. All of these potentially effected habitats were considered marginal due to dense canopy cover, but could serve as dispersal corridors. Prescribed burning would be expected to occur during the spring or fall. During spring, amphibians may be moving to breeding sites or dispersing after breeding. During the fall, herpetofauna may be moving to overwintering sites or estivating within areas to be burned. Allowing fire to creep into the SMZ (as opposed to active introduction) would provide

opportunity for herpetofauna to move away from areas burning, but not eliminate the possibility of mortality.

Direct effects to listed herpetofauna would not be anticipated from implementing the Proposed Action due to project design measures; non-detection of listed species during surveys; and no records of these species occurring within the project area subwatersheds.

Canopy Cover

Current levels of stream shading for project area perennial streams are presented in Table 9. These levels are currently within the desired condition of 70 to 80%. Naiman et al. (2000) note that riparian forests strongly influence stream microclimate; including air, soil, and surface temperatures; relative humidity; and solar radiation. Proposed commercial thinning and underburning have the potential to directly affect canopy cover or stream shading. If canopy altering treatments occurred in streamside areas there could be an increase solar radiation to the stream channel.

Streamside shading affects the amount of solar radiation that filters to the surface of the water. During late summer, solar radiation potential is greatest, air temperatures are warmest, and stream flows are lowest. Only perennial channels flow are expected to flow during this period, thus concerns over water temperature focus on these stream channels. Perennials also comprise the potential habitat for resident trout, benthic macroinvertebrates, and herpetofauna. Base flows may be augmented by the reduction in vegetation (an indirect effect), but no effect is expected within the stream channels (Kaplan-Henry and Stone 2008). Possible increases in soil moisture would be utilized by the remaining vegetation, so it would not likely be available for stream flow.

Benthic macroinvertebrates serve as food source for various lifestages of fish and herpetofauna. Kattleman (1996) notes several studies have demonstrated that communities of aquatic invertebrates changed significantly in response to upstream logging, with some of these effects persisting for two decades. Much of the food base for stream ecosystems is derived from adjacent terrestrial ecosystems with litter fall from deciduous stands exceeding that of coniferous stands. Deciduous input (leaves) generally breaks down in less than half the time necessary for the breakdown of coniferous input (needles; Gregory et al. 1991). Buffer strips 30 m (98.4 feet) wide are noted as protecting invertebrate communities from logging induced changes (Gregory et al. 1987; EPA 1991).

Dwire et al. (2006) suggest that prescribed fire may top-kill some riparian trees and shrubs. A study at Blodgett Forest in northern California introduced prescribed fire into the riparian zone and found that a 4.4% mortality rate resulted, occurring in trees 11 to 40 centimeters (4.5 to 15.7 inches) dbh (diameter at breast height; Bêche et al. 2005). Prescribed fire is not proposed for introduction into the perennial SMZs for this project, but it would be allowed to creep within the SMZ.

Perennial stream channels, which represent the potential habitat for aquatic/riparian species, would have Class I SMZs. Class I SMZs are a minimum of 100 feet from each streambank, with widths adjusted for slope as presented under project design criteria. Class I SMZs are within the Old Forest Linkage corridors. These corridors extend 150 feet from both streambanks along the perennial streams within the project area. There are no proposed treatments within the inner 50 feet from each streambank. The outer 50 feet would implement hand treatments to remove the understory ladder fuels. No alteration of the existing stream shading (> 70%) would be anticipated from the Proposed Action.

Water Temperature

As measured during the summer of 2007 (displayed in Figure 2), daily mean water temperatures in the project area were less than 21° C (desired condition). The maximum water temperatures (15 minute data) during the 2007 monitoring period are presented in Table 9. No maximum water temperatures recorded during 2007 exceeded the desired condition. There are no anticipated alterations to canopy cover, thus there would be no direct effects on water temperature anticipated from the Proposed Action.

Large Woody Debris

Table 4 indicates that subwatersheds 501.5053; 503.0010; 503.0011; and 503.0055 are lower than Desired Condition for large woody debris. Other subwatersheds lacking LWD data may also be less than desired. This condition is likely a result of historic logging that occurred throughout the project area, including riparian areas. Naiman et al. (2000) project that 80% of LWD has a stream channel residence of less than 50 years. Trees are now of sufficient size and are large enough, in combination with individual mortality, to provide additional input. The element within the SMZs that represents the most immediate source of LWD is snags. There is no proposed removal of snags within the first 50 feet from the perennial stream channel within the Old Forest Linkage corridors. Beyond 50 feet snags may be removed if they contribute to ladder conditions (generally 10 to 50 ft high). Some snags to be removed may have contributed to LWD recruitment.

Indirect Effects

Thinning to reduce ladder fuels would occur on over 800 acres under this alternative. Underburning is proposed over approximately 215 acres, and mastication on 800 acres. Table 17 identifies that perennial streams adjacent to treatment areas represent approximately 320 acres of foothill yellow-legged frog; 630 acres western pond turtle; 90 acres mountain yellow-legged frog; and 30 acres of Yosemite toad habitat, 8 miles of benthic macroinvertebrates, and 7 acres of Pacific tree frog habitat. The foothill yellow-legged frog habitat acreage is within western pond turtle habitat (overlap). Within the foothill yellow-legged frog and turtle habitat are 90 acres that would have no treatments (corridors along perennial and intermittent streams). Similarly, 30 acres of mountain yellow-legged frog habitat occurs along no treatment corridors. The perennial streams and wet meadows (MIS habitats) are also buffered by no treatment areas. The Proposed Action has a risk of compacting soil (tractor thinning, mastication, new road construction, and machine piling or slash), which could result in both short and long-term sediment delivery to riparian and aquatic habitats. Reduction in stand densities could affect canopy cover (indirectly affecting micro-climate and water temperatures), availability of large woody debris; macroinvertebrate community, and changes to water yield (indirectly affecting stream channel stability). Alterations to habitat complexity, air temperature, decreased soil moisture or relative humidity within areas adjacent to perennial streams could influence herpetofauna.

Canopy Cover

Indirect effects on canopy cover (stream shading) could occur if the Proposed Action results in an alteration to the hydrologic regime. Such alteration could be expressed in bank and channel instabilities, widening of the stream channel, and undermining of bank trees. The widening of the stream channel would increase the level of reduced canopy cover over the stream (less stream shading). Unit T-11 is proposed adjacent to a segment of stream channel that is currently has poor channel stability, within a subwatershed (503.0010) that is considered sensitive to disturbance. Project design criteria have been developed to protect the channel from further degradation, and indirect effects would not be anticipated.

Effects to canopy cover would be similar to direct effects. Alterations to habitat complexity, air temperature, decreased soil moisture or relative humidity within areas adjacent to perennial streams could influence herpetofauna.

Water temperature

Solar radiation through forest canopies depends on the heights of the crowns and density, along with the foliage (Moore et al. 2005). In evaluating possible project direct effects to canopy cover it was noted that large changes in overhead canopy from stands adjacent to perennial streams would not be anticipated. Stream shading would meet the desired condition of > 70 to 80%. However, in addition to direct solar radiation, Beschta et al. (1987) addresses possible affects from angular solar radiation and describes how canopy cover can be evaluated as angular canopy density. In the outer 50 feet of treated Old Forest Linkage (riparian corridors) there is a possible increase of open space within the understory component of the treated stand. This provides an opportunity for increased angular solar radiation. It is anticipated that the majority of the trees would be retained and the inner 50-foot no treatment zone would intercept angular solar radiation. Wilkerson et al. (2006) found that a 23 m (75 feet) buffer resulted in no change to water temperature, while a 11 m buffer (>60% canopy retention) resulted in an increased weekly maxima of 1.0 to 1.4° C. There would be no anticipated indirect change to water temperatures.

Some underburning would take place through within Old Forest Linkage corridors. When this occurs there are design measures that allow for creeping into the SMZ, but not for active introduction of fire. It is expected underburning would occur within the 100-foot zone and some understory trees could be killed as a result. It is not expected that overstory trees contributing to stream shading and blocking solar radiation would be killed by the underburning proposed under the Sugar Pine Adaptive Management Project.

Changes in stream discharge level could be potentially affected by the proposal. Altered stream discharge would be an indirect effect from the proposal, since basal area (and evapotranspiration) decline due to changes in stand density (Chamberlin et al. 1991; Kattelman 1996). If more water were available as baseflow during the late summer, there would be a possible reduction in stream temperature. Researchers have concluded that if less than 10% of the basal area is removed, there is little impact on flows (Troendle et al. 2006). Removal of between 10 and 20% of basal area may affect flow, but the change is not detectable due to the natural variability of flow. Other investigators found that approximately 20% of the basal area must be removed before a statistical change in flow is detected (Troendle et al. 2006). MacDonald and Stednick (2003) report that 15% basal area must be removed before a change in flow can be detected in small research watersheds, and detection becomes more difficult as watershed size increases. Huff et al. (2002) modeled water yield for similar treatments (thinning) in the Feather and Yuba River basins, estimating an increase of 0.3% in water yield. However, individual areas could have higher water yields within the range of variability estimated.

The Sugar Pine Adaptive Management Project Hydrology Report (Kaplan-Henry and Stone 2008) considered anticipated changes to hydrologic regime. The Project Hydrology Report notes that base flows may be augmented by the reduction in vegetation, but the effect is not likely to persist into the dry summer season where it would be detectable. The increase in soil moisture would be utilized by the remaining vegetation, so it would not be available for stream flow. Thinning trees is not expected to have much effect on hydrologic regime. It is anticipated that project design measures for Alternative 2 would maintain water temperatures within the current and desired condition (< 21° C), within the project area.

Large Woody Debris

Of the treatments that would be implemented under the Proposed Action, delivery of large woody debris could be affected by reduction in stand density through commercial harvest or underburning. It has been identified that stream channels within subwatersheds 501.0053; 503.00010; 503.0010; and 503.0055 are below desired condition for LWD. There are approximately 200 miles of stream channels within project area subwatersheds. However, this evaluation focuses the perennial and intermittent stream channels (approximately 60 miles) within project area subwatersheds. Perennial channels have Class I SMZs and are within the Old Forest Linkage corridors. However, intermittent channels (Class II SMZs) contribute water over half of the year and may be important for herpetofauna dispersal. Additionally, intermittent channels may have sufficient flow to transport smaller pieces of LWD, thus influence LWD in the perennial channels. The ephemeral channels are more likely to retain LWD rather than transport it due to limited channel capacity.

Modeling LWD recruitment has been challenging considering that tree fall patterns may be chronic or episodic and influenced by geomorphology; tree or snag angle; bank steepness; prevailing wind direction; fragmentation; decomposition; mortality rates; and stem failure (Van Sickle and Gregory 1990; Bragg et al. 2000; Bragg and Kershner 2002, 2004; Mellen and Ager 2002; Meleason et al. 2002). The models attempt to address direction of tree fall and assign probability to angle of fall or assume angle is random. The random scenario could occur if tree failure is not influenced by disturbance or geomorphology. However, Naiman et al. (2000) suggest the probability of fall direction is strongly influenced by local topography, thus trees are more likely to fall toward the channel than other directions. It appears the more mature and intact the adjacent riparian forest is, the greater the likelihood of sustained LWD recruitment (Bragg et al. 2000).

McDade et al. (1990) indicated that 70% of LWD originated within ½ stand height (20 m in that study) of the stream channel and approximately 85% of LWD would have been provided within a 30 meter (98.4 ft) buffer. Meleason et al. (2002) noted that 90% of woody inputs were found to originate within 26 meter (85 ft) for mature conifer stands. To maintain LWD recruitment, the SMZs should be between 0.75 and 1.0 tree heights. The basic premise presented by Robison and Beschta (1990) is that the probability of LWD entering a stream by direct fall is zero when the distance exceeds the tree height.

The perennial streams have Class I SMZs and are within the Old Forest Linkage (riparian corridors). There are 34 miles of perennial streams in the aquatics analysis area. Approximately 7.7 miles of stream are adjacent to or within a treatment area. The Old Forest Linkage corridors have a 50-foot no treatment buffer on the inner 50 feet of the stream channel. The remaining outer 50-feet excludes heavy mechanical equipment, but understory trees could be removed to reduce fire ladder conditions. There is no proposed removal of snags within the first 50 feet from the perennial stream channel within the Old Forest Linkage corridors. Beyond 50 feet snags may be removed if they contribute to ladder conditions (generally 10 to 50 ft high). Some of these snags may have contributed to LWD.

Class II (intermittent channels) are not likely to have flow during late summer. Class II SMZs are 75 feet (each side), and exclude heavy equipment. There are 25 miles of intermittent streams in the aquatics analysis area. Approximately 8.7 miles of stream are adjacent to or within a treatment area. When project treatments are to occur within Class II SMZs, it is primarily removal of suppressed and intermediate trees contributing to ladder fuels. It is anticipated that commercial thinning could be implemented within 25 feet of the stream. Robison and Beschta (1990) discuss the concept of effective height of the tree, which is the height to the minimum

diameter and length necessary to qualify as LWD. If a diameter of 10 cm (4 inches) is applied, the top 10 feet of the tree would not meet the LWD criteria. Thus, it is more probable that 35 feet is the minimum height that might have a probability of contributing LWD to a stream channel. These trees have potential to reach the stream channel if the occur in the band between 25 and 50 feet from the stream channel and it is probable that some would have contributed to LWD.

Underburning proposed in Rx Units 1 and 3 would take place within Class I/II SMZs. When this occurs there are design measures that allow for creeping into the SMZ, but not active introduction of fire. Dwire et al. (2006) speculate that fuels reduction could potentially directly and indirectly affect aquatic/riparian habitat by altering the recruitment of LWD. They further note that prescribed fire would not necessarily remove LWD from riparian areas, and that mortality resulting from prescribed fire would likely contribute LWD to aquatic systems. In a limited (60 acre) study of active burning within the riparian zone, Bêche et al. (2005) noted a loss of 4.4% of trees, with mortally occurring between 11 to 40 cm (4.5 to 15.7 in) dbh. In that study several snags fell after being burned, but no overall increase in the amount or movement of LWD relative to unburned control sites. These effects were similar to those theorized by Dwire and Kauffman (2003) that moister, cooler microclimates within riparian areas likely contribute higher moisture content in fuels and soils, which could lower the intensity and severity of burns. Skinner (2002) also noted that fire often consumes material in the advanced stages of decay, but also creates snags and downed logs. It is expected underburning would creep within the SMZs and some understory trees could be killed a result and possibly contribute to LWD.

Limited indirect negative effects to LWD recruitment would be anticipated as a result of implementing the Proposed Action, primarily contribution from intermittent stream segments. It is expected that LWD would remain lower than desired condition within subwatersheds 501.0053; 503.0010; 503.0011; and 503.0055 for several decades. Several other subwatersheds did not have LWD data and may also be less than desired.

Cumulative Effects

Past, present, and reasonably foreseeable actions within the project areas are displayed in Chapter 3 on page 25. For the Sugar Pine Project Area, other known activities are off-highway vehicle use; fuel, culture, and timber projects (including activities on private property); cattle grazing, road maintenance; and recreational use (both developed and undeveloped). Of the actions elevated within the analysis area, timber harvesting, (including that occurring on private lands), and cattle grazing have the greatest potential to alter aquatic habitat.

Of the actions evaluated within the analysis area, timber harvesting, including that occurring on private lands, has the greatest potential to alter aquatic habitat. Effects from timber harvesting on private land would be similar to those discussed under Alternative 1. For actions considered under Alternative 2, changes to microclimate could affect air temperature, which is one of the components affecting water temperature and quality of habitat for herpetofauna. No treatments would occur within the inner 50 feet of a Class I SMZ. When timber removal occurs in SMZs, it would be primarily from suppressed and intermediate trees that are creating fuel ladder conditions. It is not expected that overhead canopy reductions would result in large changes in solar radiation or air temperature. It is anticipated that water temperatures within the project area would be maintained within the desired condition (< 21º C) under the Proposed Action. The combination of the Federal and private timber removal is not expected to cumulatively effect LWD recruitment, which would remain lower than desired, within subwatersheds 501.0053, 503.0010, 503.0011, and 503.0055. Several other subwatersheds did not have LWD data and may also be less than desired.

The CWEA prepared for this project (Gallegos 2009) includes consideration of actions on private lands in addition to Forest Service permitted actions. The lower bound threshold of concern (TOC) in subwatersheds 501.5053 and 503.0055 are currently exceeded. Additionally, subwatersheds 501.5006, 501.5007 and 503.0010 would exceed their lower TOC as a result of implementing the proposed action. Upper bound TOC would not be exceeded if Alternative 2 were implemented. Upper and lower bounds are guidelines developed to indicate risk of cumulative effects, and to identify areas for field review. The probable result from a cumulative effect would be an increase in sediment, which would negatively affect aquatic habitat. The stream channel within subwatershed 503.0055 is the main stem of Lewis Creek. The creek through this subwatershed is primarily high gradient with a bedrock and boulder substrate, thus has limited probability of stream channel instabilities developing. Further buffering the subwatershed from sediment effects is the lower pond at Sugar Pine. The pond is not within subwatershed 503.0055, but functions as a settling basin for any sediment generated upstream of the site. The effect of the pond decreases the amount of sediment in the system, further reducing the probability of a cumulative effect in the downstream subwatershed. A cumulative watershed effect would not be anticipated from Alternative 2 (Gallegos 2008). Stream channels would be expected to remain overall stable, with some sites of localized instability. Habitat for benthic macroinvertebrates (34 miles) and Pacific tree frog (170 acres) would be expected to be stable.

The project area is primarily within the Soquel grazing allotment. Most of the primary and secondary grazing areas occur in subwatersheds 501.5005, 501.5006, and 501.5007. Proper Functioning Condition (USDI-BLM 1995) was conducted at Boggy and Soquel Meadows within the allotment in 2007. Both sites were at Properly Functioning Condition. It is expected that cattle grazing will locally result in exposed streambanks and erosion. The majority of the primary use areas are within subwatersheds that drain to North Fork Willow Creek, rather than the Fresno or Merced Rivers.

Table 20 summarizes anticipated effects from the action alternatives (Alternatives 2, 3, and 4) on aquatic threatened (T), endangered (E), sensitive (S) species, along with habitat for management indicator species (MIS).

Alternative 3

Under Alternative 3, all treatment areas would be carried forward from Alternative 2, but in areas where there are known Pacific Fisher den sites, treatments within associated den site buffer would include only those treatments needed to achieve fire and fuels objectives (treatment of surface and ladder fuels). All other treatment areas would continue to treat for both fire/fuels and forest health (stand density) objectives. Gross acres of proposed treatments by subwatershed are displayed in Table 8. The actual area treated is expected to be less (approximately 85%) similar to Alternative 2.

Table 18. Activities Proposed within Project Area Subwatersheds under Alternative 3

HUC8 Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.0010	503.0011	503.0055	503.3001	Total
Commercial/pre-commercial thinning or tractor piling	0	5	194	132	124	11	119	181	627	33	99	0	**1525**
Lower canopy treatment/pre-commercial thinning or tractor piling	0	0	0	0	0	0	178	142	0	0	63	0	**383**
Mastication	19	8	79	0	34	18	110	294	3	138	80	14	**797**
Underburn	0	9	13	0	21	22	15	113	22	0	0		**215**
No Treatments	447	2207	352	536	1639	1429	523	1280	897	474	2322	1367	**13473**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
% Subwatershed treated	4%	1%	45%	20%	10%	3%	45%	36%	42%	27%	9%	1%	**18%**

Direct Effects

Similar to Alternative 2, there could be potential direct effects from crushing of RABO, WPT, RAMU, or BUCA by tractor thinning, tractor piling, or mastication, or from burning of animals. The 5 acres of potential habitat for CRLF are the private ponds in the Sugar Pine and Fish Camp areas, which are not part of this project.

Also similar to Alternative 2, direct effects would not be expected to occur due herpetofauna primarily occupying riparian areas where proposed treatments are limited. Project design measures include the Old Forest Linkage corridors for Pacific fisher. These migration corridors extend 150 feet from both streambanks along the perennial streams within the project area. There are no proposed treatments within the inner 50 feet from each streambank. The outer 50 feet would implement hand treatments to remove the understory ladder fuels. No heavy equipment would be allowed within 100 feet of the streambank within these corridors. During primary periods of project operations (May through Sept) it is expected frogs and turtles would remain within the riparian areas due to presence of water; the microclimate provided; and riparian connectivity, except during rainy periods. The possibility of direct effects from crushing would be most likely in October when species leave streamside areas for overwintering sites, or during rainy periods when species may move beyond riparian areas. Operation of heavy equipment ceases during periods of prolonged precipitation to prevent compaction.

Introduced fire could directly affect herpetofauna similar to Alternative 2. Allowing fire to creep into the SMZ (as opposed to active introduction) would provide opportunity for herpetofauna to move away from areas burning, but not eliminate the possibility of mortality.

Direct effects to listed herpetofauna would not be anticipated from implementing Alternative 3 due to project design measures; non-detection of listed species during surveys; and no records of these species occurring within the project area subwatersheds.

Indirect Effects

Thinning to reduce ladder fuels would occur over approximately 760 acres under Alternative 3, 90 acres less than Alternative 2. Underburning is proposed over approximately 215 acres, and mastication on 800 acres. Table 17 identifies that perennial streams adjacent to treatment areas represent approximately 320 acres of foothill yellow-legged frog; 630 acres western pond turtle; 90 acres mountain yellow-legged frog; 30 acres of Yosemite toad; 8 miles of benthic macroinvertebrates, and 7 acres of Pacific tree frog habitat. The RABO habitat acreage is within WPT habitat (overlap). Within the RABO and WPT habitat are 90 acres that would have no treatments (corridors along perennial and intermittent streams). Similarly, 30 acres of RAMU habitat occurs along no treatment corridors. Effects from compaction and stand density would be similar to Alternative 2.

Canopy Cover

Currently the levels of stream shading (based on 2007 data) are within the desired condition of > 70%. Similar to Alternative 2, there would be no indirect effects on water temperature anticipated from Alternative 3. Changes to microclimate beyond the riparian corridors may affect habitat and dispersal of herpetofauna through changes to air temperature, wind speed, and relative humidity.

Water Temperature

Similar to Alternative 2, there would be no anticipated alterations to canopy cover, thus there would be no direct effects on water temperature expected from Alternative 3.

Large Woody Debris

Table 10 indicates that stream channels in subwatersheds 501.5053; 503.0010, 503.0011, and 503.0055 are lower than the desired condition for large woody debris. There is no proposed removal of snags within the first 50 feet from the perennial stream channel within the Old Forest Linkage (Riparian corridors). Beyond 50 feet snags may be removed if they contribute to ladder conditions (generally 10 to 50 ft high). Thinning to remove ladder fuels would also remove some trees that could have potential to reach a stream channel. Indirect negative effects to LWD recruitment would similar to those presented under Alternative 2.

Cumulative Effects

Past, present, and reasonably foreseeable actions within the project areas are displayed in Chapter 3 on page 25. For the Sugar Pine Project Area, other known activities are off-highway vehicle use, fuel, culture, and timber projects (including activities on private property), cattle grazing, road maintenance, and recreational use (both developed and undeveloped). Similar to Alternative 2:

- The combination of the Federal and private timber removal is not expected to cumulatively effect LWD recruitment, which would remain lower than desired within HUC8 subwatersheds 501.5053, 503.0010, 503.0011, and 503.0055.
- A cumulative watershed effect would not be anticipated from Alternative 3 (Gallegos 2009). Stream channels would be expected to remain overall stable, with some areas of localized instability.
- It is expected that cattle grazing will locally result in exposed streambanks and erosion. The majority of the primary use areas are within subwatersheds that drain to North Fork Willow Creek, rather than the Fresno or Merced Rivers.

Table 20 summarizes anticipated effects from the action alternatives (Alternatives 2, 3, and 4) on aquatic threatened (T), endangered (E), and sensitive (S) species, along with habitat for management indicator species (MIS).

Alternative 4

Gross acres of proposed treatments by subwatershed are displayed in Table 19. The actual area treated is expected to be less (approximately 85%) similar to Alternatives 2 and 3.

Table 19. Activities Proposed within Project Area Subwatersheds under Alternative 4

HUC8 Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.0010	503.0011	503.0055	503.3001	Total
Biomass/mastication/ pre-commercial thinning or tractor piling	0	5	194	132	124	11	297	323	627	33	162		**1908**
Mastication	19	8	79	0	34	18	110	294	3	138	80	14	**797**
Underburn	0	9	13	0	21	22	15	113	22	0	0		**215**
No Treatments	447	2207	352	536	1638	1429	523	1280	897	474	2322	1367	**13472**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
% Subwatershed treated	4%	1%	45%	20%	10%	3%	45%	36%	42%	27%	9%	1%	**18%**

(Acres generated by GIS)

Direct Effects

The 5 acres of potential habitat for CRLF are the private ponds in the Sugar Pine and Fish Camp areas, which are not part of this project. Similar to Alternatives 2 and 3, there could be potential direct effects from crushing of RABO, WPT, RAMU, or BUCA by biomass thinning, tractor piling, or mastication, or from burning of animals.

Similar to Alternatives 2 and 3, it would be expected that direct effects to herpetofauna would be limited. Project design measures include the Old Forest Linkage corridors for Pacific fisher. These migration corridors extend 150 feet from both streambanks along the perennial streams within the project area. There are no proposed treatments within the inner 50 feet from each streambank. The outer 50 feet would implement hand treatments to remove the understory ladder fuels. No heavy equipment would be allowed within 100 feet of the streambank within these corridors. During primary periods of project operations (May – Sept) it is expected frogs and turtles would remain within the riparian areas due to presence of water; the microclimate provided; and riparian connectivity, except during rainy periods. The possibility of direct effects from crushing would be most likely in October when species leave streamside areas for overwintering sites, or during rainy periods when species may move beyond riparian areas. Operation of heavy equipment ceases during periods of prolonged precipitation to prevent compaction.

Introduced fire could directly affect herpetofauna similar to Alternatives 2 and 3. Allowing fire to creep into the SMZ (as opposed to active introduction) would provide opportunity for herpetofauna to move away from areas burning, but not eliminate the possibility of mortality.

Direct effects to listed herpetofauna would not be anticipated from implementing Alternative 4 due to project design measures; non-detection of listed species during surveys; and no records of these species occurring within the project area subwatersheds.

Indirect Effects

Biomass thinning to reduce ladder fuels would occur on over approximately 1,065 acres under Alternative 4, which is 850 acres more than Alternative 2. Underburning is proposed over approximately 215 acres, and mastication on 800 acres. Table 17 identifies that perennial streams adjacent to treatment areas represent approximately 320 acres of foothill yellow-legged frog; 630 acres western pond turtle; 90 acres mountain yellow-legged frog; 30 acres of Yosemite toad; 8 miles of benthic macroinvertebrate, and 7 acres of Pacific tree frog habitat. The RABO habitat acreage is within WPT habitat (overlap). Within the RABO and WPT habitat are 90 acres that would have no treatments (corridors along perennial and intermittent streams). Similarly, 30 acres of RAMU habitat occurs along no treatment corridors. Effects from compaction and stand density would be similar to Alternatives 2 and 3, although somewhat less due to fewer trees being removed. Alterations to habitat complexity, air temperature, decreased soil moisture or relative humidity within areas adjacent to perennial streams could influence herpetofauna.

Canopy Cover

Currently the levels of stream shading (based on 2007 data) are within the desired condition of > 70%. Similar to Alternatives 2 and 3, there would be no indirect effects on water temperature anticipated from Alternative 4. Changes to microclimate beyond the riparian corridors may affect habitat and dispersal of herpetofauna through changes to air temperature, wind speed, and relative humidity.

Water Temperature

Similar to Alternatives 2 and 3, there would be no anticipated alterations to canopy cover, thus there would be no direct effects on water temperature expected from Alternative 4.

Large Woody Debris

Under Alternative 4, there is no proposed removal of snags within the first 50 feet from the perennial stream channel within the Old Forest Linkage (riparian corridors). Beyond 50 feet snags may be removed if they contribute to ladder conditions (generally 10 to 50 ft high). Thinning to remove ladder fuels would also remove some trees that could have potential to reach a stream channel, although the number would be fewer than Alternatives 2 or 3. Indirect negative effects to LWD recruitment would similar, but less than those presented under Alternatives 2 and 3 due to greater retention of commercial sized trees.

Cumulative Effects

Past, present, and reasonably foreseeable actions within the project areas are displayed in Chapter 3 on page 25. For the Sugar Pine Project Area, other known activities are off-highway vehicle use, fuel, culture, and timber projects (including activities on private property), cattle grazing, road maintenance, and recreational use (both developed and undeveloped). Similar to Alternatives 2 and 3:

- The combination of the Federal and private timber removal is not expected to cumulatively effect LWD recruitment, which would remain lower than desired, within HUC8 subwatersheds 501.5053, 503.0010, 503.0011, and 503.0055.
- A cumulative watershed effect would not be anticipated from Alternative 4 (Gallegos 2009). Stream channels would be expected to remain overall stable, with some sites of localized instability.
- It is expected that cattle grazing will locally result in exposed streambanks and erosion. The majority of the primary use areas are within subwatersheds that drain to North Fork Willow Creek, rather than the Fresno or Merced Rivers.

Table 20 summarizes effects to TES species and MIS habitat.

Table 20. Summary from Analyses for Aquatic Threatened, Endangered, Sensitive (BA/BE), and Management Indicator Species for Effects from Project Alternatives

Species (status)	Determination
California red-legged frog (T)	No effect
Foothill yellow-legged frog (S)	May affect individuals, but is not likely to lead to Federal listing or loss of viability.
Western pond turtle (S)	May affect individuals, but is not likely to lead to Federal listing or loss of viability.
Mountain yellow-legged frog (S)	May affect individuals, but is not likely to lead to Federal listing or loss of viability.
Yosemite toad (S)	No effect
Benthic Macroinvertebrates Habitat (MIS)	Stable
Pacific tree frog Habitat (MIS)	Stable

Source: Strand 2009, Strand 2009a

Terrestrial Management Indicator Species

The purpose of the terrestrial MIS report is to evaluate and disclose the impacts of the Sugar Pine Adaptive Management Project on the habitat of terrestrial Management Indicator Species (MIS) identified in the Sierra NF LRMP (USDA-FS 1991) as amended by the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (USDA Forest Service 2007a). The MIS report documents the effects of the proposed action and alternatives on the habitat of selected project-level MIS.

MIS are animal species identified in the SNF MIS Amendment Record of Decision (ROD) signed December 14, 2007, which was developed under the 1982 National Forest System Land and Resource Management Planning Rule (1982 Planning Rule) (36 CFR 219). The current rule applicable to project decisions is the 2004 Interpretive Rule, which states "Projects implementing land management plans…must be developed considering the best available science in accordance with §219.36(a)…and must be consistent with the provisions of the governing plan." (Appendix B to §219.35). Guidance regarding MIS set forth in the Sierra NF LRMP as amended by the 2007 SNF MIS Amendment ROD directs Forest Service resource managers to (1) at project scale, analyze the effects of proposed projects on the habitat of each MIS affected by such projects, and (2) at the bioregional scale, monitor populations and/or habitat trends of MIS, as identified in the Sierra NF LRMP as amended.

Affected Environment

MIS Habitat Status and Trend

All habitat monitoring data are collected and/or compiled at the bioregional scale, consistent with the LRMP as amended by the 2007 Sierra NF MIS Amendment ROD (USDA Forest Service 2007a).

Habitats are the vegetation types (for example, early seral coniferous forest) or ecosystem components (for example, snags in green forest) required by an MIS for breeding, cover, and/or feeding. MIS for the Sierra Nevada National Forests represent 10 major habitats and 2 ecosystem components (USDA-FS 2007a and project record). These habitats are defined using the California Wildlife Habitat Relationship (CWHR) System (CDFG 2005). The CWHR System provides the most widely used habitat relationship models for California's terrestrial vertebrate species (ibid). Appendix D includes tables explaining the acronyms used for available habitat stages in the CWHR system. It is also described in detail in the Sierra NF Bioregional MIS Report (USDA Forest Service 2008).

Habitat status is the current amount of habitat on the Sierra Nevada Forests. Habitat trend is the direction of change in the amount or quality of habitat over time. The methodology for assessing habitat status and trend is described in detail in the Sierra NF Bioregional MIS Report (USDA Forest Service 2008).

MIS Population Status and Trend

All population monitoring data are collected and/or compiled at the bioregional scale, consistent with the LRMP as amended by the 2007 Sierra NF MIS Amendment ROD (USDA Forest Service 2007a). The information is presented in detail in the 2008 Sierra NF Bioregional MIS Report (USDA Forest Service 2008).

Population monitoring strategies for MIS of the Sierra NF are identified in the 2007 Sierra Nevada Forests Management Indicator Species (SNF MIS) Amendment ROD (USDA Forest Service 2007a). Population status is the current condition of the MIS related to the population monitoring data required in the 2007 SNF MIS Amendment ROD for that MIS. Population trend is the direction of change in that population measure over time.

There are a myriad of approaches for monitoring populations of MIS, from simply detecting presence to detailed tracking of population structure (USDA Forest Service 2001, Appendix E, page E-19). A distribution population monitoring approach is identified for all of the terrestrial MIS in the 2007 SNF MIS Amendment, except for the greater sage-grouse (USDA Forest Service 2007a). Distribution population monitoring consists of collecting presence data for the MIS across a number of sample locations over time. Presence data are collected using a number of direct and indirect methods, such as surveys (population surveys), bird point counts, tracking number of hunter kills, counts of species sign (such as deer pellets), and so forth. The specifics regarding how these presence data are assessed to track changes in distribution over time vary by species and the type of presence data collected, as described in the Sierra NF Bioregional MIS Report (USDA Forest Service 2008).

Methodology for Analysis

Project-level effects on MIS habitat are analyzed and disclosed as part of environmental analysis under the National Environmental Policy Act (NEPA). This involves examining the impacts of the proposed project alternatives on MIS habitat by discussing how direct, indirect, and cumulative effects will change the habitat in the analysis area.

These project-level impacts to habitat are then related to broader scale (bioregional) population and/or habitat trends. The appropriate approach for relating project-level impacts to broader scale trends depends on the type of monitoring identified for MIS in the LRMP as amended by the SNF MIS Amendment ROD. Hence, where the Sierra NF LRMP as amended by the SNF MIS Amendment ROD identifies distribution population monitoring for an MIS, the project-level habitat effects analysis for that MIS is informed by available distribution population monitoring data, which are gathered at the bioregional scale. The bioregional scale monitoring identified in the Sierra NF LRMP, as amended, for MIS analyzed for the Sugar Pine Adaptive Management Project is summarized in Section 3 of the Terrestrial MIS report.

Adequately analyzing project effects to MIS generally involves the following steps:

- Identifying which habitat and associated MIS would be either directly or indirectly affected by the project alternatives; these MIS are potentially affected by the project.
- Summarizing the bioregional-level monitoring identified in the LRMP, as amended, for this subset of MIS.
- Analyzing project-level effects on MIS habitat for this subset of MIS.
- Discussing bioregional scale habitat and/or population trends for this subset of MIS.
- Relating project-level impacts on MIS habitat to habitat and/or population trends at the bioregional scale for this subset of MIS.

These steps are described in detail in the Pacific Southwest Region draft document “MIS Analysis and Documentation in Project-Level NEPA, R5 Environmental Coordination” (May 25, 2006). This Management Indicator Species (MIS) Report documents application of the above steps to select project-level MIS and analyze project effects on MIS habitat for the Sugar Pine Adaptive Management Project.

Mitigation and Monitoring

Special project design measures for the Sugar Pine Adaptive Management Project were developed in concert with the Bass Lake Ranger District interdisciplinary team, USFWS, PSW Research scientists, and concerned public participation groups. These design measures would be implemented under any of the three action Alternatives. Within this project area special considerations have been given to maintaining higher levels of biodiversity through actions such as delineating Old Forest Linkages (OFLs) surrounding perennial streams (see USDA-FS 2009a and 2009b for a description of OFLs). Higher levels of biodiversity have also been planned for by marking retention groups of large diameter trees. Two hundred and eighty (280) such tree groups were identified in the main project area, and an additional 74 were identified in the hydrology study area. These tree groups are composed of a cluster of three or more trees, 30 inch dbh or greater, with touching crowns, and will benefit those species which utilize dense groupings of large trees. Another project design measure which will maintain biodiversity is the identification of retention areas around large oaks within treatment units. Two to three large oaks per acre were identified and marked with paint. These oaks will retain a zone of no activity around them measuring 35 feet, or dripline circumference around the oak (whichever is greater). The delineation of OFLs, retention of large tree groups, and oak no treatment zones will ensure a heterogeneous post treatment landscape resulting in the continued accessibility of both hiding cover and prey availability within these areas of biodiversity. (USDA Forest Service 2009e)

The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Specific project design criteria include: canopy closure will be maintained at 60 to 70% or greater where available; ground disturbance will be limited to those guidelines with the LRMP as amended; vegetation species diversity and composition will be maintained; no management will occur in designated riparian reserves; and retention of snags and downed logs would be retained at 80 to 100% of the average numbers found within mature and old growth stands within the Sierra NF. Any snag felled for safety reasons will be left on site as downed woody debris. Additional cull logs will be left on site from the logging operation as well. All riparian reserves within the project have been identified and buffers established. In addition, no operations will occur during the wet weather season. (USDA Forest Service 2009e)

Category 1 MIS

Species that will not be discussed further in this document include Category 1 and Category 2 MIS. Category 1 defines MIS whose habitat does not occur in or adjacent to the project area. For the Sugar Pine Adaptive Management Project Category 1 MIS include the greater sage-grouse and the black-backed woodpecker. No sagebrush (SGB) or burned forest habitat is currently present in or adjacent to the project area.

Category 2 MIS

Category 2 defines MIS whose habitat is in or adjacent to the project area, but whose habitat would not be directly or indirectly affected by the project. For the Sugar Pine Adaptive Management Project, Category 2 MIS include: yellow warbler, sooty grouse, California spotted owl, American marten, and northern flying squirrel. Though habitat for these species occurs within the project area, that habitat will not be directly or indirectly affected by the project. The primary reasons for this appraisal are the Sugar Pine Adaptive Management Project design features which limit the activities reducing canopy closure. These design features, as well as applicable Forest Service standards and guidelines protecting species habitats are discussed

further in the Sugar Pine Adaptive Management Project MIS Report for each of the Category 2 MIS.

Category 3 MIS

The MIS whose habitat would be either directly or indirectly affected by the Sugar Pine Adaptive Management Project, identified as Category 3, are carried forward in this analysis, which will evaluate the direct, indirect, and cumulative effects of the proposed action and alternatives on the habitat of these MIS (see project record). The MIS selected for project-level MIS analysis for the Sugar Pine Adaptive Management Project are: fox sparrow, mule deer, mountain quail, and hairy woodpecker.

The following section documents the analysis for the following Category 3 species: fox sparrow, mule deer, mountain quail, and hairy woodpecker. The analysis of the effects of the Sugar Pine Adaptive Management Project on the terrestrial MIS habitat for the selected project-level MIS is conducted at the project scale. The analysis used the California Wildlife Habitat Relationship model (CWHR (Mayer and Laudenslayer 1988)) data to determine vegetative type within the entire Sugar Pine Adaptive Management Project Boundary. Existing acres of vegetation type (base vegetation layer) were determined using the Sierra National Forest Corporate GIS vegetation feature class of 2001 ExistingVeg2001_pl. This base layer was refined using existing structure analysis from more than 50 stand examination plot data collected in 2007 and 2008, as well as forest aerial photography interpretation from the 2001 flightline, and 1 meter resolution satellite imagery from the National Agricultural Imagery Program (NAIP). Treatment acres relative to existing vegetation were based on mapping and field visits conducted by the Bass Lake Ranger District Silviculturist. These field visits refined the base vegetation layer and determined the net acres of treatment. Detailed information on the MIS is documented in the SNF Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

MIS Project-level Effects Analysis - Shrubland (West-Slope Chaparral) Habitat

Current Condition of the Habitat Factor(s) in the Project Area: There are a total of 71 acres of shrubland (chaparral) habitat within the project boundary. Sixty-five (65) acres are classified as montane chaparral (MCP) and the remaining 6 acres are classified as mixed chaparral (MCH). Of the 71 acres of chaparral within the project boundary, only 38%, or 27 acres occur within treatment analysis areas and have the potential to be treated under this project while only 21 acres are actually proposed to be treated. Please refer to Tables 40 and 41 in Appendix D (Sugar Pine CWHR Data Table, Main Project Area and Hydrology Study Area, Present Compared to Alternative 2 Proposal) for a full breakdown of all CWHR habitat types within the project boundary pre- and post-treatment.

Alternative 1 – No Action

Alternative 1 is the No Action Alternative. Under the No Action Alternative, current management plans would continue to guide management of the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences. The No Action Alternative would not implement the Sugar Pine Adaptive Management Project to reduce fire ladder conditions (thinning); pile slash for burning; burn slash piles; masticate and/and or precommercially thin stands; plant trees; reduce fuel loading through controlled burning; construct handline around jackpot burn areas; or construct and reconstruct roads.

Direct and Indirect Effects to Habitat

There are no direct effects to shrubland habitat under this alternative. There is a potential for indirect effects under the No Action Alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects (USDA Forest Service 2009a, 2009c, 2009d).

Cumulative Effects to Habitat in the Analysis Area

According the Council on Environmental Quality (CEQ) NEPA regulations, "cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR 1508.7).

The cumulative effects boundary area was identified as the extent of the 12 HUC 8 subwatersheds contained in or adjacent to the project boundary: 503.0008, 503.0009, 503.0010, 503.0011, 503.0055, 503.3001, 501.5003, 501.5005, 501.5006, 501.5007, 501.5053, and 501.5054 and covers an area of 16,381 acres. Past, present, and reasonably foreseeable actions within all 12 subwatersheds surrounding the project area are displayed in Table 3 of the Sugar Pine Adaptive Management Project Environmental Impact Statement (USDA-FS 2009a, USDA 2009f).

Cumulative Effects Conclusion

Under Alternative 1 the Sugar Pine Project would not be implemented. The immediate effect of wildfires in shrubland habitat would be a loss of function for that portion of the habitat until shrubs recovered enough to provide foraging, nesting, and cover habitat. However because most shrubland ecosystems are fire adapted, and because most fires burn with a mosaic of severity and intensity across the landscape, post fire shrub habitats may still provide forage, nesting, and cover for many species. Unfortunately, without fuels treatments, the extent of shrublands severely impacted by wildfire is expected to be much greater and take much longer for recovery, having more lasting impacts on the distribution and abundance of this habitat type on the landscape.

Within the cumulative effects analysis area, other known activities are off-highway vehicle use, fuel, culture, and timber projects (past Federal and activities on private property), cattle grazing, road maintenance, and recreational use (both developed and undeveloped). Many of the ongoing management activities within the cumulative effects boundary do not contribute to significant cumulative impacts upon shrubland habitat. Of the actions elevated within the analysis area, road maintenance along the 86 miles of road and plantation maintenance of the 115 acres of existing plantation within the extended subwatershed boundary area would be the most likely actions to affect shrubland habitat. Changes in shrubland densities would be relatively short-lived because many shrubs would sprout within a year (depending on shrub type, treatment type, and treatment intensity). There are a total of 861 acres of MCH and MCP habitat within the cumulative effects boundary of this project, of which a very small percentage may be treated during road and plantation maintenance activities. Any cumulative effects to shrubland habitat would be minimal as a result of choosing Alternative 1, and in the absence of a catastrophic wildfire, habitat would be expected to remain in fair condition.

Alternative 2 – Proposed Action

Direct and Indirect Effects to Habitat

Under Alternative 2 direct effects to 21 acres of shrubland habitat are proposed through mastication and prescribed burning treatments. These 21 acres would be treated to maintain the growth and vigor of existing trees, or to create conditions suitable for the establishment of planted trees. The change in seral stage of 21 acres of chaparral out of 71 acres within the project boundary is a treatment of 38% of the total chaparral available within the Sugar Pine Project Boundary. There are an additional 50 acres of shrubland habitat identified within the project boundary that are not proposed for treatment under the current project, and would still provide suitable habitat for fox sparrow during implementation of mastication and burning activities.

Two (2) acres of proposed prescription burning would occur in MCP habitat in the hydrology study area, and 19 acres of proposed mastication treatments would occur in MCP habitat in the main project area. Immediately after treatment, these 21 acres would not be useable as shrubland habitat because shrubs would be reduced below 20 percent cover. This shrub cover reduction would be temporary, and shrubs would likely begin to recover in less than one year since chemicals would not be used in either treatment. Shrubland habitat that is currently senescent would be brought back to an early seral stage chaparral, increasing its vigor and habitat value.

Cumulative Effects to Habitat in the Analysis Area

A table of current and future projects within the analysis area for the Sugar Pine Adaptive Management Project was presented in the Cumulative Effects discussion of Alternative 1. There are a total of 861 acres of MCH and MCP habitat within the cumulative effects boundary of this project. This project proposes treating at most 3% of the existing shrubland habitat within the cumulative effects boundary.

Cumulative Effects Conclusion

There are a total of 861 acres of MCH and MCP habitat within the cumulative effects boundary of this project. This project proposes treating at most 3% of the existing shrubland habitat within the cumulative effects boundary. Further activities taking place within the cumulative effects boundary that may alter shrubland habitat include road brushing and plantation maintenance. These activities may alter a very small percentage of the available shrubland habitat through removal of senescent chaparral bordering roads and inside plantations, resulting in natural regeneration of early seral stage chaparral habitat.

Alternative 3

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for the shrubland habitat within Alternative 3 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 3 would be the same as those discussed under the Proposed Action.

Alternative 4

The proposed treatments for the shrubland habitat within Alternative 4 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 4 would be the same as those discussed under the Proposed Action.

Summary of Fox Sparrow Status and Trend at the Bioregional Scale

The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the fox sparrow; hence, the shrubland effects analysis for the Sugar Pine Adaptive Management Project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the fox sparrow. This information is drawn from the detailed information on habitat and population trends in the Sierra Nevada Forests Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

Habitat Status and Trend

There are currently 922,000 acres of west-slope chaparral shrubland habitat on National Forest System lands in the Sierra Nevada. Within the last decade, the trend is stable.

Population Status and Trend

The fox sparrow has been monitored in the Sierra Nevada at various sample locations by avian point counts and breeding bird survey protocols, including: 1997 to present – Lassen National Forest (Burnett and Humple 2003, Burnett et al. 2005); 2002 to present – Plumas and Lassen National Forests (Sierra Nevada Research Center 2007); on-going monitoring through California Partners in Flight Monitoring Sites (CPIF 2002); 1992 to 2005 – Sierra Nevada Monitoring Avian Productivity and Survivorship (MAPS) stations (Siegel and Kaschube 2007); and 1968 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007). These data indicate that fox sparrows continue to be present at these sample sites, and current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in the population trend, the distribution of fox sparrow populations in the Sierra Nevada is stable.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Fox Sparrow Trend

The 861 acres of shrubland habitat that exists within the Cumulative Effects (CE) boundary account for less than 1% of the 922,000 acres that exists at the bioregional scale, and only 21 of these acres are proposed for treatment. Therefore, cumulative impacts within the CE boundary would not alter the existing bioregional trends in this habitat, nor would they lead to a change in the distribution of fox sparrows across the Sierra Nevada bioregion.

Oak-Associated Hardwoods and Hardwood/Conifer Habitat (Mule deer)

Current Condition of the Habitat Factor(s) in the Project Area

There are currently 850 acres of montane hardwood and montane hardwood conifer habitat within the Sugar Pine Adaptive Management Project boundary of which 53% or 450 of these acres are within treatment analysis areas. Please refer to Tables 40 and 41 located in Appendix D (Sugar Pine CWHR Data Table, Main Project Area and Hydrology Study Area, Present Compared to Alternative 2 Proposal) for a full breakdown of all CWHR habitat types within the Project boundary pre- and post-treatment.

Alternative 1 – No Action

Direct and Indirect Effects to Habitat

There would be no direct effects to montane hardwood or montane hardwood-conifer habitat under this alternative. There is a potential for indirect effects under the No Action Alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the adjacent conifer stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects (USDA Forest Service 2009a, 2009c, 2009d).

Cumulative Effects to Habitat in the Analysis Area and Conclusion

Past, present, and reasonably foreseeable actions within the 12 subwatersheds inside and adjacent to the project area are displayed in Table 3 of this document, referenced from the Sugar Pine Adaptive Management Project Environmental Impact Statement (USDA-FS 2009a). Under Alternative 1 the Sugar Pine Project would not be implemented. The immediate effect of wildfires in hardwood and hardwood/conifer habitat would be a loss of function for that portion of the habitat until the hardwoods recovered enough to provide foraging, and nesting habitat. However because most hardwood ecosystems are fire adapted, and because most fires burn with a mosaic of severity and intensity across the landscape, post fire hardwood habitats may still provide forage, nesting, and cover for many species. Unfortunately, without fuels treatments in the conifer types, the extent of hardwood habitat severely impacted by wildfire is expected to be much greater and take much longer for recovery, having more lasting impacts on the distribution and abundance of this habitat type on the landscape.

Many of the ongoing management activities within the cumulative effects boundary do not contribute to significant cumulative impacts upon montane hardwood or hardwood/conifer habitat. Of the cumulative effects actions elevated within the analysis area, private land residential development and roadside hazard tree removal have the greatest potential to alter hardwood and hardwood conifer habitat. There is a total of 3341 acres of MHC and MHW habitat within the cumulative effects boundary. Hardwood and hardwood/conifer habitats account for 20% of the total available habitat in the cumulative effects boundary. It is possible that a very small percentage of MHC and MHW habitat may be removed as hazards during roadside hazard tree removal or as residential construction continues within the cumulative effects boundary. Any cumulative effects to hardwood and hardwood/conifer habitat would be minimal as a result of choosing Alternative 1, and in the absence of a catastrophic wildfire, habitat would be expected to remain in good condition.

Alternative 2 – Proposed Action

Direct and Indirect Effects to Habitat

A direct effect of implementing Alternative 2 would be a change in CWHR type for 2 acres of mule deer habitat. Although not the intent of the proposed prescribed burning, it is possible that 2 acres of MHC4D habitat would be converted to MHC4M habitat through flare-ups during burning activities. This would represent a less than 1% decrease in the amount of MHC4D habitat within the project boundary, and a 3% increase in the amount of MHC4M habitat available within the project boundary. With the application of the LRMP standards and guidelines, direct and indirect effects to deer will be minimal because the most important habitat types to deer will receive the management emphasis called for in the LRMP, and the Sugar Pine Adaptive

Management Project uneven-aged silvicultural treatments and prescribed burning will tend to improve deer foraging habitat. Forest Service standards and guidelines pertaining to hardwood habitat are included in the project record. Additional protections for hardwood habitat that will be applied to this project include the formation of oak no treatment areas, described on page 15 of this document and in the project EIS and BE/BA (US Forest Service 2009a, 2009b).

Cumulative Effects to Habitat in the Analysis Area and Conclusion

Of the cumulative effects actions elevated within the analysis area, private land residential development and roadside hazard tree removal have the greatest potential to alter hardwood and hardwood conifer habitat. There is a total of 3341 acres of MHC and MHW habitat within the cumulative effects boundary. The proposed treatment of 2 acres would constitute a treatment of less than 1% of the total available habitat within the cumulative effects boundary. Additional effects to habitat through roadside hazard tree work and private land residential development will be insignificant compared with the amount of habitat available.

Alternative 3

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for the montane hardwood and montane hardwood/conifer habitat within Alternative 3 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 3 would be the same as those discussed under the Proposed Action.

Alternative 4

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for the montane hardwood and montane hardwood/conifer habitat within Alternative 4 are very limited in scope and will not change any CWRH habitat type, size, or density, therefore no direct effects to montane hardwood and montane hardwood/conifer habitat would be expected to occur with implementation of Alternative 4. Indirect effects can be expected by failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects. (USDA Forest Service 2009a, 2009c, 2009d).

Summary of Mule Deer Status and Trend at the Bioregional Scale

The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the mule deer; hence, the oak-associated hardwood and hardwood/conifer effects analysis for the Sugar Pine Adaptive Management Project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the mule deer. This information is drawn from the detailed information on habitat and population trends in the Sierra Nevada Forests Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

Habitat Status and Trend

There are currently 809,000 acres of oak-associated hardwood and hardwood/mixed conifer habitat on National Forest System lands in the Sierra Nevada. The trend is slightly increasing (within the last decade, changing from 5% to 7% of the acres on National Forest System lands).

Population Status and Trend

The mule deer has been monitored in the Sierra Nevada at various sample locations by herd monitoring (spring and fall) and hunter survey and associated modeling (CDFG 2007). California Department of Fish and Game (CDFG) conducts surveys of deer herds in early spring to determine the proportion of fawns that have survived the winter, and conducts fall counts to determine herd composition (CDFG 2007). This information, along with prior year harvest information, is used to estimate overall herd size, sex and age rations, and the predicted number of bucks available to hunt (ibid). These data indicate that mule deer continue to be present across the Sierra Nevada, and current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in some herds or Deer Assessment Units, the distribution of mule deer populations in the Sierra Nevada is stable.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Mule Deer Trend

The 3341 acres of montane hardwood and montane hardwood/conifer habitat that exists within the Cumulative Effects boundary account for less than 1% of the 809,000 acres that exists at the bioregional scale. The change of 2 acres out of 809,000 acres of oak-associated hardwood and hardwood/conifer habitat in the Sugar Pine Adaptive Management Project Area will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of mule deer across the Sierra Nevada bioregion.

Early and Mid Seral Coniferous Forest Habitat (Mountain quail)

Current Condition of the Habitat Factor(s) in the Project Area

There is currently 3,566 acres of early and mid seral coniferous forest habitat within the Sugar Pine Adaptive Management Project boundary of which 58% or 2064 acres of this habitat are within treatment analysis areas. Please refer to Tables 40 and 41 located in Appendix D (Sugar Pine CWHR Data Table, Main Project Area and Hydrology Study Area, Present Compared to Alternative 2 Proposal) for a full breakdown of all CWHR habitat types within the Project boundary pre- and post-treatment.

Alternative 1 – No Action

Direct and Indirect Effects to Habitat

There would be no direct effects to early and mid seral coniferous habitat under this alternative. There is a potential for indirect effects under the No Action Alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects (USDA Forest Service 2009a, 2009c, 2009d).

Cumulative Effects to Habitat in the Analysis Area and Conclusion

Past, present, and reasonably foreseeable actions within the 12 subwatersheds inside and adjacent to the project area are displayed in the Sugar Pine Adaptive Management Project Environmental Impact Statement (USDA-FS 2009a). Under Alternative 1 the Sugar Pine Project would not be implemented. The immediate effect of wildfires in early and mid seral coniferous habitat would be a loss of function for that portion of the habitat until the habitat recovered enough to provide foraging, and nesting habitat. Without fuels treatments, the extent of early and mid seral habitat

severely impacted by wildfire is expected to be much greater and take much longer for recovery, having more lasting impacts on the distribution and abundance of this habitat type on the landscape.

There is a total of 8171 acres of early and mid seral coniferous habitat within the cumulative effects boundary. These habitat types constitute 50% of the total available habitat in the cumulative effects boundary. Many of the ongoing management activities within the cumulative effects boundary do not contribute to significant cumulative impacts upon early and/or mid seral coniferous forest habitat. Of the cumulative effects actions elevated within the analysis area private land residential development, roadside hazard tree removal, on-going plantation maintenance, and past and future timber sale activity have the greatest potential to alter early and mid seral coniferous habitat.

It is possible that a small percentage of early and mid seral stage coniferous habitat may be removed as residential construction continues within the cumulative effects boundary. It is reasonable to assume that some portion of the roadside hazard trees are in the later stages of early seral habitat, as well as mid and late seral habitat. Nevertheless, removal of a few trees within a stand does not change its habitat rating. Therefore, roadside hazard tree removal would not impact either early, mid, or late seral habitat. Early and mid seral habitats treated under ongoing plantation maintenance projects likely have or will experience better health, vigor, and growth by being released from competition.

About 2,640 acres of thinning occurred within the CE boundary during the 1980s, with an additional 2000 to 3000 acres proposed for future treatment under the Fish Camp Adaptive Management project in the next few years. Due to the thinning prescriptions implemented under previous projects, seral stages did not change. Stands merely reflected less density. It is expected that those stands treated have experienced better health, vigor, and growth and will be less susceptible to wildfires. Proposed Fishcamp Project prescriptions should mirror those proposed under the Sugar Pine Adaptive Management project, including any special design measures for wildlife recently developed for the Sugar Pine Project. Any cumulative effects to early and mid seral coniferous habitat within the cumulative effects boundary would be minimal as a result of choosing Alternative 1, and in the absence of a catastrophic wildfire, habitat would be expected to remain in good condition.

Alternative 2 – Proposed Action

Direct and Indirect Effects to Habitat

Under Alternative 2, minimal changes in CWHR composition of early and mid seral coniferous habitat are proposed for a little over 1% of the 3,566 acres of habitat within the project boundary. 37 acres of PPN3D would be converted to PPN3M through proposed mechanical thinning treatments. One (1) acre of PPN4D would likely be converted to PPN4M through proposed prescribed burning. Three (3) acres of SMC3D would be converted to SMC3M through proposed mechanical thinning work, and 5 acres of SMC4D would be converted to SMC4M through proposed prescription burning. The remaining 2,018 acres of early and mid seral coniferous habitat within the treatment analysis acres will not experience a change in CWHR habitat type, size, or density under the Alternative 2 proposal. Due to the thinning prescriptions proposed, additional seral stage changes beyond those described will not change. Stands will merely reflect less density. Where stand density is at 60% or greater, it will not be brought below this level. It is expected that those stands treated will experience better health, vigor, and growth and will be less susceptible to wildfires.

Cumulative Effects to Habitat in the Analysis Area and Conclusion

There is a total of 8,171 acres of early and mid seral coniferous habitat within the 12 subwatershed cumulative effects boundary. These habitat types constitute 50% of the total available habitat within that boundary. Many of the ongoing management activities within the cumulative effects boundary will not contribute to significant cumulative impacts upon early and/or mid seral coniferous forest habitat. Of the cumulative effects actions elevated within the analysis area private land residential development, roadside hazard tree removal, on-going plantation maintenance, and past and future timber sale activity have the greatest potential to alter early and mid seral coniferous habitat as discussed under the cumulative effects section for Alternative 1. Additional effects through Alternative 2 proposed canopy cover changes of 0.5% of the total habitat in the cumulative effects boundary are insignificant, especially when one considers the vast amount of available early and mid seral coniferous habitat present within the cumulative effects boundary.

Alternative 3

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for the early and mid seral stage coniferous habitat within Alternative 3 are nearly the same as for Alternative 2. Under Alternative 3, minimal changes in CWHR composition of early and mid seral coniferous habitat are proposed for a little over 1% of the 3,566 acres of habitat within the project boundary. Seventeen (17) acres of PPN3D would be converted to PPN3M through proposed mechanical thinning work. One (1) acre of PPN4D would likely be converted to PPN4M through proposed prescribed burning. Three (3) acres of SMC3D would be converted to SMC3M through proposed mechanical thinning work, and 5 acres of SMC4D would be converted to SMC4M through proposed prescription burning. The remaining 2,018 acres of early and mid seral coniferous habitat within the treatment analysis acres will not experience a change in CWHR habitat type, size, or density under the Alternative 3 proposal. Additional effects through Alternative 3 proposed canopy cover changes of 0.3% of the total habitat in the cumulative effects boundary are insignificant considering the vast amount of available habitat within the cumulative effects boundary. Due to the thinning prescriptions proposed, additional seral stage changes beyond those described will not change. Stands will merely reflect less density. Where stand density is at 60% or greater, it will not be brought below this level. It is expected that those stands treated will experience better health, vigor, and growth and will be less susceptible to wildfires.

Alternative 4

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for the early and mid seral stage coniferous habitat within Alternative 4 are very limited in scope and will not change any CWRH habitat type, size, or density, therefore no direct effects to early and mid seral coniferous habitat would be expected to occur with implementation of Alternative 4.

Indirect effects can be expected by failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects (USDA Forest Service 2009a, 2009c, 2009d).

Summary of Mountain Quail Status and Trend at the Bioregional Scale

The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the mountain quail; hence, the early and mid seral coniferous forest effects analysis for the Sugar Pine Adaptive Management Project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the mountain quail. This information is drawn from the detailed information on habitat and population trends in the SNF Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

Habitat Status and Trend

There are currently 546,000 acres of early seral and 2,766,000 acres of mid seral coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada. Within the last decade, the trend for early seral is slightly decreasing (from 9% to 5% of the acres on National Forest System lands) and the trend for mid seral is slightly increasing (from 21% to 25% of the acres on National Forest System lands).

Population Status and Trend

The mountain quail has been monitored in the Sierra Nevada at various sample locations by hunter survey, modeling, and breeding bird survey protocols, including California Department of Fish and Game hunter survey, modeling, and hunting regulations assessment (CDFG 2004a, CDFG 2004b) and 1968 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007). These data indicate that mountain quail continue to be present across the Sierra Nevada, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of mountain quail populations in the Sierra Nevada is stable.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Mountain Quail Trend

The 8,171 acres of early and mid seral coniferous habitat that exists within the cumulative effects boundary account for 1.5% of the 546,000 acres that exists at the bioregional scale. The change in canopy closure of 46 acres out of 809,000 acres of early and mid seral coniferous habitat in the Sierra Nevada bioregion will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of mountain quail across the Sierra Nevada bioregion.

Snags in Green Forest Ecosystem Component (Hairy woodpecker)

Habitat/Species Relationship

The hairy woodpecker was selected as the MIS for the ecosystem component of snags in green forests. Medium (diameter breast height [dbh] between 15 to 30 inches) and large (diameter breast height greater than 30 inches) snags are most important. The hairy woodpecker uses stands of large, mature trees and snags of sparse to intermediate density; cover is also provided by tree cavities (CDFG 2005). Mature timber and dead snags or trees of moderate to large size are apparently more important than tree species (Siegel and DeSante 1999).

Project-level Effects Analysis – Snags in Green Forest Ecosystem Component

Current Condition of the Habitat Factor(s) in the Project Area

Prior to 2004, the forest implemented standards and guidelines (S&Gs) from the Sierra NF LRMP (USDA-FS 1991) which called for maintaining an average of 1.5 snags per acre in sizes 15 to 24-inch dbh and an average of 0.5 snags per acre in sizes 25-inch dbh or greater. All countable snags had to be 20 feet or greater height (S&G #64, p. 4-16). Additionally, a sufficient number of live trees had to be left in appropriate sizes to serve as replacement snags. The Sierra Nevada Forest Plan Amendment (SNFPA) (2004), modified the Sierra NF LRMP with the followings guidelines: (1) in westside mixed conifer and ponderosa pine types, Forests should maintain 4 of the largest snags per acre, (2) in red fir forest type, they should maintain 6 of the largest snags per acre, (3) in eastside pine and mixed conifer forest types, they should maintain 3 of the largest snags per acre, and (4) in westside hardwood ecosystems, they should maintain 4 of the largest snags (hardwood or conifer) per acre, or if standing live hardwood trees lack dead branches, they should maintain 6 of the largest snags per acre (S&G #11, p. 51).

Current conditions within the project boundary meet and in many areas exceed the snag and down woody material retention guidelines laid forth in the 2004 SNFPA. The following standards and guidelines for Snags and Down Woody Material apply to this project (USDA-FS 2004, Pg. 51-52).

Alternative 1 – No Action

Direct and Indirect Effects to Habitat

There would be no direct effects to snags in green forest habitat under this alternative. There is a potential for indirect effects under the No Action Alternative as the continued immediate threat of wildfire would remain unabated. In failing to make an attempt at density management of the stands, the eventual changes through drought stress and subsequent insect and disease mortality acceleration would exacerbate the threat of stand replacing fire. Such a wildfire would convert current snags in green forest habitat to snags in burned forest habitat. Additionally, the high probability of a drying climate change throughout the Western United States would have the potential to further compound these effects (USDA Forest Service 2009a, 2009c, 2009d).

Cumulative Effects to Habitat in the Analysis Area and Conclusion

Past, present, and reasonably foreseeable actions within the 12 sub-watershed cumulative effects boundary are displayed in Table 3 of this document, referenced from the Sugar Pine Adaptive Management Project Environmental Impact Statement (USDA-FS 2009a). Under Alternative 1 the Sugar Pine Project would not be implemented. The immediate effect of wildfires would convert current snags in green forest habitat to snags in burned forest habitat.

There is a total of 12,015 acres of mid and late seral forest habitat that provides the green forest snag component within the cumulative effects boundary. These habitat types constitute 73% of the total available habitat in the cumulative effects boundary. Many of the ongoing management activities within the cumulative effects boundary do not contribute to significant cumulative impacts upon mid and/or late seral forest habitat. Of the cumulative effects actions elevated within the analysis area private land residential development, roadside hazard tree removal, on-going plantation maintenance, and past and future timber sale activity have the greatest potential to alter snags within mid and late seral coniferous habitat.

It is possible that a small percentage of snags may be removed as residential construction continues within the cumulative effects boundary. It is reasonable to assume that all of the roadside hazard trees are snags in varying stages of decay. Roadsize hazard tree removal is slated for 41 miles of road within the cumulative effects boundary. However, only trees that are a public safety hazard (ROD Appendix A page 29) and up to a potential maximum distance of 300 feet on either side of the road are slated for removal (US Forest Service 2006b). This removal of public safety hazard trees along linear features is not expected to bring the available snag levels within the proposed project area below the current standards set forth in the ROD.

Alternative 2 – Proposed Action

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

There would be minimal direct effects to snags under the Alternative 2 proposed action. No snags are proposed for removal by any of the Action alternatives in the Sugar Pine Adaptive Management Project, except where they constitute a safety concern. Current conditions within the project boundary and cumulative effects boundary meet and in many areas exceed the snag and down woody material retention guidelines laid forth in the 2004 SNFPA. It is reasonable to assume that a few stage 4 through 7 snags may be lost in prescribed fire treatment areas, however this treatment is also likely to produce stage 2 and 3 snags. It is not expected that removal of snags that pose a safety concern along roadways or in treatment units will alter the available snag levels below the current standards set forth in the ROD.

Alternative 3

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for forest snags within Alternative 3 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 3 would be the same as those discussed under the Proposed Action.

Alternative 4

Direct, Indirect, and Cumulative Effects to Habitat and Conclusion

The proposed treatments for forest snags within Alternative 4 are the same as for Alternative 2, therefore the direct, indirect, and cumulative effects for Alternative 4 would be the same as those discussed under the Proposed Action.

Summary of Hairy Woodpecker Status and Trend at the Bioregional Scale

The Sierra NF LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the hairy woodpecker; hence, the snag effects analysis for the Sugar Pine Adaptive Management Project must be informed by both habitat and distribution population monitoring data. The sections below summarize the habitat and distribution population status and trend data for the hairy woodpecker. This information is drawn from the detailed information on habitat and distribution population trends in the SNF Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

Ecosystem Component Status and Trend

The current (based on 2001-2004 inventory sources) average number of medium-sized and large-sized snags (≥ 15-inch dbh, all decay classes) per acre across major coniferous and hardwood forest types (westside mixed conifer, ponderosa pine, white fir, productive hardwoods, red fir, eastside pine) in the Sierra Nevada ranges from 1.4 per acre in eastside pine to 8.3 per acre in

white fir. Detailed information by forest type, snag size, and snag decay class can be found in the SNF Bioregional MIS Report (USDA Forest Service 2008).

Data from the mid-to-late 1990s were compared with the current data to calculate the trend in total snags per acre by Regional forest type for the 10 Sierra Nevada national forests and indicate that, during this period, snags per acre increased within westside mixed conifer (+0.80), white fir (+1.98), and red fir (+0.68) and decreased within ponderosa pine (-0.17), productive hardwoods (-0.17), and eastside pine (-0.16).

Population Status and Trend

The hairy woodpecker has been monitored in the Sierra Nevada at various sample locations by avian point counts and breeding bird survey protocols, including 1997 to present – Lassen National Forest (Burnett and Humple 2003, Burnett et al. 2005); 2002 to present – Plumas and Lassen National Forests (Sierra Nevada Research Center 2007); 1992 to 2005 – Sierra Nevada Monitoring Avian Productivity and Survivorship (MAPS) stations (Siegel and Kaschube 2007); and 1968 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007). These data indicate that the hairy woodpecker continues to be present at these sample sites, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of hairy woodpecker populations in the Sierra Nevada is stable.

Relationship of Project-Level Habitat Impacts to Bioregional-Scale Hairy Woodpecker Trend

The 12,015 acres of mid and late seral forest habitat that provides the green forest snag component within the cumulative effects boundary account for less than 1% of the 3,835,000 acres of mid and late seral coniferous forest habitat within the Sierra Nevada bioregion. Therefore, none of the alternatives would alter the bioregional trend in the snag component of the coniferous forest habitat, nor would they lead to a change in the distribution of the hairy woodpecker across the Sierra Nevada bioregion.

Hydrology/Water Quality

Affected Environment

The project area has been affected by a history of past fires and historic logging. Currently the Sugar Pine Railroad is active today and serves as a destination for recreation. The current condition of creeks in the project area shows current uses and effects of past activity.

The Sugar Pine Adaptive Management Project is located in the Upper Lewis Creek Watershed and a portion of the Big Sandy Creek watershed. Upper Lewis Creek, Lewis Fork of the Fresno River is tributary to the Fresno River Watershed. Fresno River is tributary to the San Joaquin River, which supplies water to a four billion a year agricultural industry in the Central Valley. All of the discharge from Big Sandy Watershed, White Chief Branch and headwaters to Big Creek at one time flowed into Big Creek, which is tributary to south fork of the Merced River. Big Creek drainage has had up to 6000 acre-feet of water is diverted between December 1st and July 15th into the Lewis Fork of the Fresno River along a ditch located in section 30 just east of the project boundary. This diversion has occurred since the 1870s. Channel conditions have adjusted since the time of diversion to reach equilibrium. Table 21 provides a summary of the affected drainages and associated water bodies in the project area. Map 9, found in the Map Package in Appendix A displays the location of perennial streams and subwatersheds associated with the project.

Table 21. Subwatershed Summaries

Main Stream System(s)	Watershed (HUC 5)	Subwatersheds (HUC 8)	Stream miles			
			Perennial	Intermittent	Ephemeral	Total
Lewis Creek	Fresno River (1804000701)	503.0008 503.0009 503.0010 503.0011 503.0055 503.3001	16.6	11.5	112.2	140.3
Big Creek	SF Merced (1804000803)	501.5003 501.5005 501.5006 501.5007 501.5053 501.5054	17.1	13.5	90.5	121.1

Summary of Existing Conditions

Although there is evidence of past logging practices, channels appear to have recovered. Stream Condition Inventories and Channel Stability Analysis were performed in most of the watersheds associated with the project. The locations of these inventories were selected based on their potential to respond to disturbance. They are by definition “response reaches” and represent the

most delicate reach along the drainage surveyed. These areas provide the best locations to monitor as these areas would be the first to change. The current condition for most of the stream reaches is good or fair for channel stability using modified Pfankuch, after Rosgen (2004). The one exception is upper Lewis Creek, which rated a poor.

Alternative 1 – No Action

Direct effects associated with not treating fuels in the project area would result in a lost opportunity to reduce potential for catastrophic fire. This lost opportunity has the potential to affect not only the communities at risk; it also affects the riparian habitat and water quality in the project area. As described in the affected environment, riparian areas have large amounts of organic material throughout the drainages. This material is not lying on the forest floor; it is intermingled with standing material. In the event of a wildfire, riparian habitat, channel characteristics and riparian vegetation would be greatly affected.

Direct Effects

Direct effects of no actions would be continued increase of fuels and potential for catastrophic wildfire.

Indirect Effects

Indirect Effects of no action would be basin wide increases of fuels and potential for catastrophic wildfire.

Cumulative Effects

Cumulative Effects of no action would be displayed under the Pre project condition of the Cumulative Watershed Effects (CWE) analysis described under Best Management Practices (BMP) #7-8. Essentially the only watershed considered at or near CWE prior to field investigations was Lewis-Red Rock (503.0055). Filed investigations indicated that this drainage is predominately bedrock controlled and has little potential to be affected by the project. Additionally SCI investigations indicate Channel Stability using modified Pfankuch (Rosgen, 2001) is good.

Table 22. Activities Proposed under Alternative 1 – No Action Alternative

Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.001	503.0011	503.0055	503.3001	Total
Commercial or pre-commercial thinning or tractor piling	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Precommercial Thin	0	0	0	0	0	0	0	0	0	0	0	0	
Mastication	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Underburn	0	0	0	0	0	0	0	0	0	0	0	0	**0**
No Treatments	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**

Alternative 2 – Proposed Action

The Proposed Action would reduce fire ladder conditions through removing understory trees (thinning); pile slash for burning; burn slash piles; masticate and/and or precommercially thin stands; plant trees; reduce fuel loading through controlled burning; construct handline around jackpot burn areas; and construct and reconstruct road. Proposed treatments by subwatershed are displayed in Table 23.

Limited or no treatment would occur in SMZs. Direct treatments would be excluded from SMZs; in general, all vegetation and fuel treatments conducted in RCAs would focus on improving forest health, enhancing or maintaining hydrologic function and maintaining or enhancing the key attributes of riparian habitats. Attributes comprise cool, moist soil conditions; high water quality; retention of large snags and down logs in sufficient quantities to provide habitat and woody debris recruitment in stream channels; and retention of woody material to provide stability to riparian and aquatic habitats. Well-functioning channels have good riparian vegetation, good sediment transport, and stable streambanks. These characteristics work together to maintain channel function and stability.

A wide range of activity-specific BMPs are designed to minimize detrimental soil disturbance, protect water quality, maintain physical stability, and hydrologic connectivity of riparian and aquatic habitats. There is little potential for the Proposed Action to adversely affect the geomorphic, hydrologic, or riparian characteristics and aquatic habitats in affected watersheds because of the low-impact characteristics of the proposed stand treatments, the limitations that would be imposed on operations within RCAs and SMZs, and the use of activity-specific BMPs.

The greatest potential for the Proposed Action to affect the hydrologic connectivity of streams and aquatic habitat exists at stream crossings. To minimize the potential for project-related effects on hydrologic connectivity, existing crossings would be used whenever possible. In the event that it is necessary to construct a temporary crossing, the methods used for construction would be selected to avoid or minimize detrimental soil and vegetation disturbance and to maintain hydrologic connectivity between upstream and downstream features. All temporary crossings would be removed following the completion of project-related activities and would be treated as necessary to restore pre-project conditions. Implementation of the activity-specific BMPs would further ensure that hydrologic connectivity in streams and special aquatic features is not adversely affected by the Proposed Action.

Table 23. Activities Proposed within Project Area Subwatersheds under Alternative 2 (Acres Generated by GIS)

Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.0010	503.0011	503.0055	503.3001	Total
Commercial/pre-commercial thinning or tractor piling	0	5	194	132	124	11	297	323	627	33	162		**1908**
Mastication	19	8	79	0	34	18	110	294	3	139	80	14	**797**
Underburn	0	9	15	0	21	22	15	113	22	0	0		**215**
No Treatments	447	2207	352	536	1638	1429	524	1280	897	473	2322	1367	**13472**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
% Subwatershed treated	4%	1%	45%	20%	10%	4%	45%	35%	42%	27%	9%	1%	**18%**

Direct Effects

Direct effects are those occurring at the same time and place as the triggering action. The Proposed Action could directly affect aquatic resources, primarily as a result of vegetation removal, road construction, slash piling, and prescribed fire immediately following treatment; such activities could lead to soil disturbance and its associated effects on aquatic habitats (e.g., accelerated erosion and sedimentation). Any soil displacement, compaction, or change in ground cover would cause a direct effect on watershed condition and aquatic habitat. Most treatment units have avoided crossing stream channels. The exception is 4th order ephemeral draws. Fuels treatments have been laid out to utilize designated and/or existing crossings. Figure 1, located on page 15, displays SMZs assigned to streams in the Sugar Pine project. Streamcourses are to be protected under C6.5 of the Timber Sale Contract. Any additional streams identified during operations will receive protection appropriate for the stream and the treatment.

Subwatershed 503.0008

There are approximately 3.8 miles of NFTS road currently in need of maintenance or reconstruction to reduce sediment. Lower gradient reaches are sensitive and have the potential to be affected by units T4 and M8. The main channel draining the 503.0008 subwatershed is a Class I perennial creek that begins in unit RX3 and runs adjacent to M7, T4, and through M8. There is a 100 foot SMZ assigned to this section of the drainage. Road 6S90 intersects the headwaters of the creek. There are no small tributaries to the main drainage of this watershed affected by road 5S18 as drainages were not noticed above this road. Other tributaries to the main stem channel in the watershed have SMZs that range from 25 to 75 feet.

Subwatershed 503.0010

Upper Lewis Creek forms the west fork to Lewis Fork Creek. This channel has low to moderate gradients below road 5S17 and steeper gradients upstream of the road. Above the road the channel exhibits a marshy character suggestive of past logging practices when streamside zones were not protected as they are today. This thick, very wet accumulation of organic and sedimentary debris has been downcut 2+ feet. The channel flows in this downcut reach. The downcut reach has a very wide flood plain. The riparian area should be avoided by management activity because it is easily damaged due to its wet character.

The only units that propose to have new road construction are units T-7 and T16 (Section 26). There are two possible routes that could be constructed: an east-west route that would connect FS road 6S07 to State Highway 41; and a roughly north-south road connecting FS road 5S17 to State Highway 41. The possible east-west route crosses a Class II stream with an SMZ of 75 feet; the possible north-south route crosses a Class I stream with an SMZ of at least 100 feet. The location of these potential crossings would be done in close coordination with aquatics and earth science to alleviate any concerns relative to riparian dependent species and follow applicable Standards and Guides (100, 101) in accordance with RCO#2. Moreover, any effects from the crossings would be mitigated by applicable BMPs for road and building site construction (in USDA-FS 2000a p. 53-81).

Tributary drainages in subwatershed 503.0010 are Class I to Class IV drainages. The drainage in unit T8 paralleling road 5S79, sec. 35/36, was closely evaluated. At the creek crossing along this road a culvert is non functional and water is concentrating along the roadbed. This is causing rilling down the road and should be fixed during road reconstruction. This area is recovering from past logging and is currently stable, but very delicate. Crossing this channel has the potential to affect the stability of the channel. Unit T-11 is proposed adjacent to a stream channel that is

currently in poor condition, within a subwatershed (503.0010) that is considered sensitive to disturbance. Project design criteria have been developed to protect the channel from further degradation. Thinning trees is not expected to have much effect on annual yield or increase peak flows.

Indirect Effects

Indirect effects are those that occur at a later time or at a distance from the triggering action. Indirect effects are expected to be minor. Conservation measures incorporated into the project would be implemented to control erosion and sedimentation. The implementation of BMPs would avoid or minimize potential increases in sediment loads to streams during project implementation such that prescribed fires are not expected to affect aquatic habitats. Over the longer term, potential adverse effects on water and soils from implementing the Proposed Action are expected to be minor, and substantially less than if an uncontrolled wildfire were to occur.

Cumulative Effects

Based on field investigations and level of protection provided by BMPs, specifically SMZ width and associated treatment prescribed in RCAs in addition to wildlife considerations, it is not expected that any CWE would occur.

The only watershed considered being at or near CWE prior to field investigations was Lewis-Red Rock (503.0055). Field investigations indicated that this drainage is predominately bedrock controlled and has little potential to be affected by the project.

Alternative 3

Under Alternative 3, the main focus would continue to be on the development of Strategically Placed Landscape Area Treatments (SPLATs) and creating defensible fuel profiles near key transportation corridors and in the defensive zone of the wildland urban intermix (WUI), similar to Alternative 2 (proposed action). Alternative 3 would differ from the proposed action in that fisher den sites would be buffered and a Limited Operating Period (LOP) implemented. Treatment within the dens site would include ladder and surface fuels (within the lower and mid-canopy levels) needed to achieve fuels objectives within the WUI zones. If a new den site(s) were located during implementation, a 700-acre buffer and LOP would be established. Treatments outside the buffer would remain the same as Alternative 2. Table 24 shows a comparison of acreage between Alternative 2 and 3. The mastication and Rx burn methodologies would not change within the buffer, but the thinning treatment would differ as described above.

Table 24. Activities Proposed within Project Area Subwatersheds under Alternative 3

HUC8 Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.0010	503.0011	503.0055	503.3001	Total
Commercial/pre-commercial thinning or tractor piling	0	5	194	132	124	11	119	181	627	33	99	0	**1525**
Lower canopy treatment/pre-commercial thinning or tractor piling	0	0	0	0	0	0	178	142	0	0	63	0	**383**
Mastication	19	8	79	0	34	18	110	294	3	138	80	14	**797**
Underburn	0	9	13	0	21	22	15	113	22	0	0		**215**
No Treatments	447	2207	352	536	1639	1429	523	1280	897	474	2322	1367	**13473**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
% Subwatershed treated	4%	1%	45%	20%	10%	3%	45%	36%	42%	27%	9%	1%	**18%**

Direct Effects

Direct effects are those occurring at the same time and place as the triggering action. The direct effects would be similar to those described under Alternative 2, except in subwatersheds 503.0008, 503.0009, 503.0055 in that there would be less impact because the thinning methodology would only concentrate on ladder and surface fuels (within the lower and mid-canopy levels).

Indirect Effects

Indirect effects are those that occur at a later time or at a distance from the triggering action. Like Alternative 2, indirect effects are expected to be minor. Conservation measures incorporated into the project would be implemented to control erosion and sedimentation. The implementation of BMPs would avoid or minimize potential increases in sediment loads to streams during project implementation such that prescribed fires are not expected to affect aquatic habitats. Over the longer term, potential adverse effects on water and soils from implementing the Alternative 3 are expected to be minor, and substantially less than if an uncontrolled wildfire were to occur.

Cumulative Effects

Based on field investigations and level of protection provided by BMPs, specifically SMZ width and associated treatment prescribed in RCAs in addition to wildlife considerations, it is not expected that any CWE would occur.

The only watershed considered being at or near CWE prior to field investigations was Lewis-Red Rock (503.0055). Alternative 3 has less ground disturbing activities and field investigations indicated that this drainage is predominately bedrock controlled and thus has little potential to be affected by the project.

Alternative 4

Under Alternative 4, the main focus would continue to be on the development of Strategically Placed Landscape Area Treatments (SPLATs) and creating defensible fuel profiles near key transportation corridors and in the defensive zone of the wildland urban intermix. Treatments in these areas would include only those needed to reduce ladder and surface fuels (within the lower and limited mid-canopy levels) needed to achieve fire and fuels objectives, and no additional treatments (i.e., additional thinning in the mid-level canopy) would occur.

Gross acres of proposed treatments by subwatershed are displayed in Table 25. The actual area treated is expected to be less (approximately 85%) similar to Alternatives 2 and 3.

Table 25. Activities Proposed within Project Area Subwatersheds under Alternative 4 (Acres Generated By GIS)

HUC8 Subwatershed	501.5003	501.5005	501.5006	501.5007	501.5053	501.5054	503.0008	503.0009	503.0010	503.0011	503.0055	503.3001	Total
Biomass/mastication/pre-commercial thinning or tractor piling	0	5	194	132	124	11	297	323	627	33	162		**1908**
Mastication	19	8	79	0	34	18	110	294	3	138	80	14	**797**
Underburn	0	9	13	0	21	22	15	113	22	0	0		**215**
No Treatments	447	2207	352	536	1638	1429	523	1280	897	474	2322	1367	**13472**
Subwatershed Acres	466	2229	638	668	1817	1480	945	2010	1549	645	2564	1381	**16392**
% Subwatershed treated	4%	1%	45%	20%	10%	3%	45%	36%	42%	27%	9%	1%	**18%**

Direct Effects

Direct effects are those occurring at the same time and place as the triggering action. The direct effects would be less than those described under Alternative 2, in that there would be less impact because the thinning methodology would only concentrate on ladder and surface fuels within the lower and mid-canopy levels.

Indirect Effects

Indirect effects are those that occur at a later time or at a distance from the triggering action. Like Alternative 2, indirect effects are expected to be minor. Conservation measures incorporated into the project would be implemented to control erosion and sedimentation. The implementation of BMPs would avoid or minimize potential increases in sediment loads to streams during project implementation such that impacts to aquatic habitats are not expected. Over the longer term, potential adverse effects on water and soils from implementing Alternative 4 are expected to be minor, and substantially less than if an uncontrolled wildfire were to occur.

Cumulative Effects

Based on field investigations and level of protection provided by BMPs, specifically SMZ width and associated treatment prescribed in RCAs in addition to wildlife considerations, it is not expected that any CWE would occur.

The only watershed considered being at or near CWE prior to field investigations was Lewis-Red Rock (503.0055). Alternative 3 has less ground disturbing activities and field investigations indicated that this drainage is predominately bedrock controlled and thus has little potential to be affected by the project.

Forest Vegetation/Silviculture

Affected Environment

The Sugar Pine Adaptive Management Project area has a history of numerous past logging activities. Over the past 125 years several small lumber mills have been supplied with logs from conifer stands within and adjacent to the proposed project area. During the 1880s a lumber mill along California Creek within Nelder Grove processed giant sequoia trees from Nelder Grove. Other small mills in the vicinity of the project as well as larger mills in the Oakhurst area also processed trees from within the project boundaries. Between 1923 and 1927 heavy railroad clearcut logging was carried out by the Madera Sugar Pine Company. through much of the project area. Logs from railroad logged stands were transported to the mill at Sugar Pine over its 140 miles of track. The mill operated for 32 years averaging a 40 million board foot cut each year. Seven locomotives and 100 log hauling cars were in use during its peak.

During the railroad logging at the beginning of the last century, logs were yarded by a system of cable settings. Deep gouging occurred in a number of places where logs dug into the soil as they were yarded to landings. As logs approached landings, more soil was generally displaced. In many cases, this reduced soil depths to almost bare rock. Settings can often be distinguished by a lack of conifer reproduction and an abundance of brush still today. However, between cableways, existing reproduction was often protected from damage. Logging slash was not treated following harvest. Today, much of this early reproduction remains as stands of generally 90 to 110 year old 6 to 24 inch dbh incense cedar, sugar pine, ponderosa/Jeffrey pine, and white fir.

During the 1960s, a significant effort was made throughout California to reforest, previously forested areas that were understocked. Approximately 180 acres that were railroad logged within the proposed project boundaries were planted during this period.

Exclusion of fire from the vast majority of the area since the fires of the early 1900s resulted in the development of multi-layered stands. The understory layers consist of fir and incense cedar beneath young growth stands of ponderosa/Jeffrey pine, sugar pine, incense cedar, and white fir with, in some cases, an additional layer of brush beneath or adjacent. In pine plantations, incense cedar and white fir and /or brush have seeded in, thus creating significant fuel ladders.

Although pockets of older trees can be found scattered through the proposed project area, past railroad and other logging as well as stand replacing fires have resulted in little of the area being vegetated with trees older than 130 years. The natural stands proposed for thinning within the project area generally consist of approximately 90 to 110 year old trees that were young saplings during the railroad logging era. Due to the warmer and drier predominately west and south aspects within the project area, the majority of stands present are considered to be pine types. These stands, once heavy to more fire resistant ponderosa and sugar pine, have become very heavy to less fire resistant incense cedar and fir. Plot data indicates that in many areas incense cedar comprises 40 to 80 percent of the basal area sampled. Mixed conifer aggregations and stands occupy areas near cooler, damper draws and at the higher elevations within the project area. Pine, mixed conifer and white fir stand basal area stocking varies from 120 ft^2 per acre in more open areas to oak pockets to densely stocked pockets of 350 to 400 ft^2 per acre or more. Canopy cover varies substantially across the project area. Canopy cover ranges from quite dense (80 to 100%) in overstocked areas to clumpy dense patches in less uniformly stocked areas to more moderate (50 to 70%) to fairly light in other locations. A number of brushfields, resulting

from previous fires and early 1900s logging, are broken up by clumps of live and black oak and are found throughout the project area.

Climatic Changes

Tree ring studies have established that compared to the previous two centuries weather during the 20th Century was relatively moist without the decades-long droughts that occurred earlier (Ferrell 1996). Beginning in the 1970s temperatures began to warm noticeably. This warming resulted in a greater fraction of the Sierra Nevada precipitation falling as rain rather than snow, earlier snowmelt and earlier streamflow peaks (Dettinger 2004). The combination of reduced stand vigor and excessive stocking combined with increasing temperatures and decreasing soil moisture availability is greatly increasing the threat of loss due to mortality from insect attack, diseases, competition, or fire.

The wetter than normal 20th Century coupled with the exclusion of fire has set the stage for stands to become overcrowded with competing conifers, oaks and other vegetation. Wide swings in climatic conditions over the past 30 years have placed stress on many of these stands. Inter-tree competition, drought, rising temperatures, and insect attacks are beginning to take a toll on both plantation and wild stand trees. White pine blister rust has also been killing a number of sugar pine over the past 10 to 15 years. Dead and down fuel loadings have been on the rise. These conditions are not unique to the Sugar Pine area. More extreme examples can be found in the Lake Tahoe Basin, San Bernardino National Forest and in Arizona and New Mexico where entire stands of trees are dieing. In southern California the amount of ponderosa pine mortality associated with western pine beetle, *D. brevicomis* Le Conte, infestations reached unprecedented levels after years of extended drought (Fettig 2007).

Recurrent droughts are characteristic of the Sierra Nevada climate. Summers are usually hot and dry, with the bulk of the precipitation occurring in winter, much of it as snow. But in addition to the dry summers, there have been droughts of 1 or more years in duration in every decade of this century. Increased mortality usually occurs first at the lower and middle elevations on both western and eastern slopes of the range and spreads to the upper elevations only if the drought is protracted. During droughts, lack of spring precipitation has a particularly large influence, not only by increasing the susceptibility of the trees, as indicated by their rates of growth and beetle-caused mortality, but also probably aiding dispersal of and host selection by the flying beetles. In the ponderosa pine type because of the relatively low elevation, water availability, not temperature, is the strongest factor limiting forest growth (Ferrell 1996).

As stated previously, beginning in the 1970s temperatures began to warm noticeably. Seasonal snowmelt and streamflow is projected to occur a month earlier during the current century. By the end of the 21st Century, 30 percent less water is anticipated to arrive in reservoirs between April and July. Soil moistures will dry out earlier and by summer be more severely depleted. Substantial changes in extreme temperature episodes (fewer frosts, more heat waves) are anticipated (Dettinger 2004). Over the past 17 to 29 years noncatastrophic mortality rates were found to have doubled over a series of 76 western forest plots. Increasing mortality rates could result in substantial changes in forest structure, composition, and function. This doubling of background mortality could cause a >50% reduction in average tree age in a forest, and a potential reduction in average tree size (van Mantgem 2009). Current projections of warming climates provide a greater opportunity for fire ignitions due to longer fire seasons. A higher probability of fire starts coupled with the changes in forest fuel conditions that occurred over the past century lead many to predict that large, generally more intense fires will become more likely than occurred historically (Skinner and Stephens 2004).

Desired Condition

The Sierra Nevada Forest Plan Amendment Record of Decision, 2004 (USDA-FS 2004) addressed the desired condition, management intent and management objectives for individual land allocations. These were brought forward in the Fresno River Landscape Analysis (July 2005).

The Sugar Pine Adaptive Management Project boundary encompasses many different land allocations, some with specific desired conditions, i.e. spotted owl/goshawk/pacific fisher habitat and some with generalized desired conditions. In effect, all center on the need to restore both the structure and processes of old forest habitat ecosystems as a long-term strategy and with short-term goals of reducing the adverse effect of wildfire and reducing stand susceptibility to insects/pathogens, competition and drought-related tree mortality.

Density Management Measures

Basal Area Stocking Levels

Normal basal area stocking is considered to be that level at which mortality begins as additional growth takes place. Normal is generally described as basal area per acre and is the maximum amount of vegetation an acre can be adequately sustain over time. For a short period of time, basal areas in excess of normal can be maintained in some areas. A normal stand—or fully stocked stand—is a stand that, so far as any practical consideration is involved, utilizes its site completely. Maximum stocking is not implied; it practically never exists over a continuous area of more than a few acres (Meyer 1938). These normal stocking levels were calculated during the abnormally wet 20th Century and are most likely too dense to be maintained during the drier periods that are more likely the norm. Fairly recent studies have indicated that the exclusion of fire may have also resulted in normal basal area densities in excess of what would have been found during previous centuries.

Four different yield tables are being used to determine normal stocking within the project area:

- Yield of Even-aged Stands of Ponderosa Pine, Technical Bulletin No 630 (Meyer 1938).
- Preliminary Yield Table for Second-growth Stands in the California Pine Region, Technical Bulletin 354, Mixed Conifer (Dunning and Reineke 1933).
- Yield, Stand, and Volume Tables for White Fir in the California Pine Region, Bulletin 407 (Schumacher 1926).
- Growth Models for Ponderosa Pine: I. Yield of unthinned plantations in northern California, Research Paper, PSW-133 (Oliver and Powers 1978).

As stands approach 80 to 90 percent of normal stocking, growth rates begin to decline significantly, stand vigor begins to suffer, and susceptibility to insect and disease attacks and drought stress increases. To reduce growth losses, maintain more viable stands, and retain canopy covers less susceptible to crown fires, this entry would thin stands to stocking levels that with growth will result in reaching 80 percent of normal in 15 to 20 years when the next thinning entry would need to take place. Utilizing basal area to describe desired stocking automatically takes into account varying diameters of trees within stands. For a given basal area, more trees per acre are retained in the residual stand in areas with smaller diameter trees than in areas of larger trees. The silvicultural prescriptions for ponderosa pine, mixed conifer and fir will be described utilizing basal area per acre.

The desired condition for stocking levels and the measure used for comparison of alternatives is:

- Average basal area in pine, mixed conifer, and white fir grouped by lightly and heavily stocked aggregations
- Average potential basal area growth
- Basal area following thinning - ponderosa pine - 135 ft^2 per acre (50% normal)
- Basal area following thinning - mixed conifer - 210 ft^2 per acre (60% normal)
- Basal area following thinning - white fir - 240 ft^2 per acre (60% normal)

Stand Density

Another approach to stocking density management is Stand Density Index (SDI). This method compares stocking density to the maximum number of stems found by species which is substantially greater than that utilized for normal yield. Mortality studies completed in pine stands have been described using this density management approach rather than normal yield tables. Since SDI was used as a frame of reference for ponderosa pine in these studies, it will be used as well as basal area to describe the silvicultural prescriptions for pine stands. SDI studies have determined that the onset of competition between trees begins when stands reach 25 percent of SDI max. At 35 percent of SDI max the lower limit of full site occupancy and susceptibility to bark beetle attack begins, and at 60 percent SDI max is where the lower limit of self-thinning begins (normal stocking). Stands that approach SDI 365 usually suffer large losses from bark beetle epidemics—losses that equal or exceed periodic growth. The limiting SDI for ponderosa pine stands in northern California as defined by Dendroctonus bark beetles is 365 (45 percent of SDI max—approximately 200 ft^2 basal area). Studies have shown that the vigor of trees in a stand is related to their ability to quickly respond to thinning and their susceptibility to various pests. A live crown ratio of at least 40 percent has been cited for a number of conifers as representing a generally acceptable level of individual tree vigor. For several coniferous species, a live crown ratio of 40 percent seems to correspond with an SDI of about 50 percent of the maximum SDI for the species. Catastrophic (extremely high) tree mortality from bark beetles can be prevented by reducing stand density below 150 ft^2 per acre in basal area (33 percent of SDI max) (Long 1985). To ensure prompt response to thinning and minimize mortality, pine stands should be maintained between 30 and high of 50 percent of SDI max.

For this proposed project, forested stands would meet stocking (as measured by percent of normal for the given site) and the associated density levels (as measured by basal area for a given site) that would maintain or improve growth rates, would increase resistance to mortality agents (insects/pathogens/fire) and would provide the potential to begin the perpetuation of both the structure and processes of old forest habitat ecosystems. This desired condition incorporates both short and long-term goals, but is focused on the need for continued maintenance of stands that are healthy and sustainable.

The desired condition for Stand Density Index and the measure used for comparison of alternatives is:

- SDI - ponderosa pine 30 percent of SDI max (135 ft^2 per acre)

Methodology for Analysis

In determining the existing condition and analyzing the effects of the alternatives associated with the Sugar Pine Adaptive Management Project, many sources of information were utilized. These included aerial photography interpretation, field verification of stand conditions, cruise plot data validation, evaluation and summarization, California Wildlife Habitat Relationship site-specific vegetation type correction and verification, and experience in the implementation of similarly

designed past projects. Scientific and research documentation was utilized to evaluate the potential effects of all alternatives and in determining the measures to be evaluated for meeting the purpose and need with regards to forest health.

The SNFPA 2004 describes the use of thinning from below as the primary silvicultural prescription to utilize in managing stand densities to provide resiliency and sustainability during drought conditions and climate variations. Stand density index and basal area (ft^2 per acre) are used as common measures in determining the effects of management actions on coniferous stands. For retention of maximum growth and vigor, thinning entries should be timed to occur before growth rates in potential leave trees begin to slow. At this point, leave trees are still retaining substantial crown ratios and have the greatest potential for maximum growth. Thinning should be undertaken before crown ratios drop below 40 percent (Emmingham 1983) (Long 1985). As competition between trees increases, crown vigor decreases. A stand's ability to respond to thinning progressively declines the longer it remains in competition. Some stands proposed for treatment are currently at this maximum potential response level while others are beginning to decline and should have already been treated.

For this project stand density (number of stems per acre) as well as basal area (ft^2 per acre) is used to determine which stands/aggregations are considered overcrowded and in need of thinning (treatment area designation), at what stocking level the stand/aggregation needs to be (desired condition), the silvicultural prescription for each alternative and the associated short (immediate) and long-term (length of effectiveness of treatment) effects of design criteria (specifically those associated with old forest habitat dependent species), and the effects the standards and guidelines and land allocations have on meeting the purpose and need for forest health.

Alternative 1 – No Action

Direct Effects

With this alternative, no commercial, biomass or pre-commercial thinning would be accomplished. Understory incense cedar, white fir and brush cover would continue to increase in size and density. Fuel ladders and competition between trees would increase. Growth rates and vigor would continue to decline as stands, or portions of stands, continue to approach or exceed normal stocking. Understocked plantations would not be replanted.

Indirect and Cumulative Effects

Wide swings in climatic conditions as has been experienced over the past thirty years would continue to place increased stress on these untreated stands. Trees in overstocked and/or brush choked plantations would continue to experience increased competition. Mixed conifer and fir aggregations and stands with stocking levels approaching or exceeding normal would become increasingly susceptible to mortality. Excessive stand/aggregation densities in ponderosa pine stands would result in the likelihood of heavy mortality. Drought and insect induced mortality would escalate. Insect infestation centers would likely move onto private property and organizational camps. Snags and jack-strawed down material would increase. Basal area tree growth of only 15 to 20 ft^2 per acre would occur over a 15 to 20 year period (if excessive mortality does not occur) in more densely stocked aggregations. Forest health in the area would decline and elevate the risk of loss due to wildfire. Not only would the potential for loss of these stands to insect attack and drought increase, but their ability to respond to future thinning would continue to decline as crown vigor deteriorated as treatment was postponed. Experience has shown that even a course of no action is not without consequence (Fettig 2007). Doing nothing

will result in forests that continue to deteriorate over time because wildfire today no longer operates in its historical fashion, that of frequent low-intensity surface fires (Fitzgerald 2005).

Fuel continuity would not be broken up. Brushfields and over stocked precommercial size conifer pockets would not be treated. The threat of fire moving into or out of population centers within the Wildland Urban Intermix (WUI) would increase, not decrease. Nelder Grove would remain highly susceptible to significant damage from fire. The threat of loss of wildlife habitat designated as Protected Activity Centers (PACs), Home Range Core Areas (HRCAs) and fisher den site buffers would increase. Agee (2005) concludes in his report that the No Action Alternative is not a risk-free option, as dry climates regularly predispose forests to burn in a typical dry summer. He further states that the impacts of no action in dry forest ecosystems must recognize the likelihood of stand-replacing, intense fire where stand density has increased and dead fuel accumulated in excess of historical levels.

Alternative 2 – Proposed Action

Under Alternative 2, the development of Strategically Placed Area Treatments (SPLATs) would occur. Additional areas would be treated to provide a defensible fuels profile near key transportation corridors and within the defense zone of the wildland urban intermix. In addition to those treatments needed to meet fire and fuels objectives, treatments would be undertaken to reduce stand densities (basal area and/or pre-commercially thin) to a level that maintains or improves the growth and vigor of remaining trees. Treatments included in this alternative are: thinning from below in conifer stands (either precommercially, biomassing or commercially), and/or masticating excess vegetation (conifers and brush) to reduce lower, mid-level (intermediates and co-dominants) canopy stand densities; masticating brush and shrub patches; prescribed burning, both understory and piles; manually reducing and/or prescribed burning noxious weed infestations; and site preparing, planting and subsequently hand releasing failed conifer plantations.

As part of the proposed action, design criteria common to all alternatives have been incorporated and are part of the proposed action. As such, analysis of the direct, indirect and cumulative effects of the action alternative addresses not only the proposed action, but the effects of these design criteria as they relate to vegetation and silvicultural management in the project area.

Direct Effects

Commercial thinning needs to be undertaken in the approximately 90 to 110 year old young growth stands and pine plantations to reduce competition and provide room for crown expansion by removing the more poorly growing trees, excess trees, and fuel ladders from these stands before competition results in much additional reduction in growth, or competition, insect, disease or fire related mortality increases.

Studies have shown that active management through thinning is critical to maintaining healthy trees that are less susceptible to mountain pine beetle attack. A 1998 study assessed the effects of thinning from below (alone and in combination with prescribed burning) on tree growth, leaf physiology and several environmental factors in ponderosa pine on the Gus Pearson Natural Area in Arizona. Soil water content was greater in thinned treatments than in the unthinned control. Similar findings have been reported in northern Arizona and western Montana, and can be attributed to increased water availability resulting from decreased tree competition. Trees in thinned treatments had greater foliar nitrogen content, needle toughness and basal area increment. The results suggest that restoration treatments improved tree vigor, growth and decreased the likelihood of bark beetle attacks on individual trees. A similar study compared measures of tree

susceptibility to bark beetle attack in thinned ponderosa pine plots in northern Arizona. Phloem thickness significantly increased with decreasing stand density. Duration of resin flow and 24 hr resin flow were significantly higher in thinned plots. Increases in these variables suggest improved host vigor and reduced likelihood of bark beetle attack. An increase in predawn xylem water potential, net photosynthetic rate, foliar nitrogen concentration and bud and needle size resulting in increasing foliar growth and uptake of water and nutrients was reported in similar stands. It has been noted that phloem thickness and basal area increment were lower in unmanaged stands than in managed. Studies have shown that thinning significantly reduced the amount of ponderosa pine mortality caused by mountain pine beetle in northeastern California (Fettig 2007). The largest increase in photosynthetic rate and predawn water potential increases due to thinning was found to be during periods of drought (Feeney 1998). Several studies have shown that thinning from below not only reduces ladder fuels and the risk of torching, but by reducing stand density tree vigor is improved and risk to bark beetle attack reduced (Fitzgerald 2005). By reducing competition through thinning, mistletoe infected residual trees will experience increased height growth thus slowing the upwards spread of mistletoe into tree crowns (Ferrell 1996). By increasing tree vigor, diseased trees will be better able to withstand the effects of drought or insect attack.

This entry would commercially or biomass thin stands on slopes generally less than 35% outside of PACs, and Old Forest Linkages to stocking levels that, with current growth, would result in returning stands to 80 percent of normal basal area stocking 15 to 20 years following harvesting (Table 37 in Appendix D displays a sampled data comparison of existing to proposed action conditions for species composition, age, site, numbers and sizes of trees, basal area, crown closure, mean diameters and number of plots taken). Maintaining a stocking level that remains at 80 percent or less of full (normal) stocking will ensure a healthy rate of growth while retaining a level of stocking that will be better able to survive the lower levels of yearly precipitation that were common prior to the past century. Black oaks will be retained in treated stands longer by reducing competition and overtopping by nearby conifers. Treated stands would also be less susceptible to climatic fluctuations and longer summer dry spells which appears to be becoming more and more prevalent. Reentry in 15 to 20 years was chosen for several reasons: (1) reduce the number of entries into the stand, (2) increase the volume removed to make the entry more economically viable, (3) open the stand sufficiently to permit harvest operations with a minimum of damage to the residual stand, (4) treat the stand to a level where for a period of at least 10 years, fires except under the most extreme conditions, would remain as ground fires and not become crown fires as directed by the National Fire Plan, (5) retain canopy covers that meet or exceed those directed under the SNFPA 2004 while opening the canopy to maintain or improve growth and vigor over 15 to 20 years.

To obtain some benefits from thinning, while retaining species specific canopy cover levels following harvest, thinning in wild pine stands is proposed to generally reduce stocking to leave basal areas of around 150 to180 ft^2 per acre depending on age, site, and existing crown condition (55 to 60 percent of normal—32 to 40 percent SDI max). This entry will still result in the retention of basal areas substantially above the stand density index recommends for thinning (150 ft^2 should be in locations where leave trees have full crowns and 180 ft^2 per acre should be in areas with poorer crown leave trees, higher growing sites, older trees and in HRCAs). Normal stocking for this site and age is 270 to 290 ft^2 per acre. Portions of stands with larger diameter trees present will generally have fewer residual trees per acre than those with smaller diameter trees. Because this entry would retain a higher basal area than the desired condition, to maintain stand resiliency, the next thinning entry may need to take place at 10 to 15 years in these pine stands rather than the planned 15 to 20 as the more limited growing space becomes reoccupied.

Where diameter restrictions permit, young growth, approximately 90 to 110 year old, mixed conifer and white fir stands would be thinned to 55 to 65 percent of normal. Leave basal areas, depending on site index and age, would be around 210 ft^2 per acre (MC) and 240 ft^2 (WF). (Normal basal area stocking for 90 to 110 year old mixed conifer stands on similar sites ranges from 330 to 360 ft^2 per acre. Normal for White Fir ranges from 420 to 445 ft^2 per acre). Canopy covers that meet or exceed those directed under the Sierra Nevada Framework would be retained following treatment. To obtain maximum growth and reduce fuel ladders, 4 to 9 inch dbh trees not needed for stocking are planned to be removed with this entry within the treatment areas not designated as mastication or prescribed fire. Portions of a number of units include short, steep pitches to 50 percent. These can be harvested by directional felling and endlining logs to more gentle slopes where they can be skidded to landings. Except for mastication equipment, equipment use on these steeper slopes should be avoided.

Thinning to these target basal areas in these approximately 90 to 110 year old young growth stands should result in basal area increases of 70 to 80 ft^2 per acre over 15 to 20 years. If thinning did not occur, this increase in growth over the same time period would be 15 to 20 ft^2 per acre within the more heavily stocked aggregations if mortality does not occur.

Except where retained for wildlife purposes, suppressed, intermediate, damaged and diseased then finally co-dominant trees, in order of removal, would be harvested until the prescribed stocking level has been reached. This is known as thinning from below as directed in the 2004 ROD and recommended in the North, et al, 2009 paper. The poorest quality trees are removed first, leaving the best trees in the stand. Thinning from below retains the majority of the crown cover and generally the largest trees. Many small, poor crowned trees are removed during the operation. Some poorer crowned co-dominant trees are removed, as needed, to create openings on one or more sides of other co-dominant and dominant trees. These openings provide room for crown expansion of the residual trees. Without room for expansion, remaining tree crowns will become less vigorous resulting in reduced photosynthesis and declining growth. Removal of only intermediate and suppressed trees results in “little more than the salvage of trees which will inevitably die (Smith 1962)”. Removal of some of the trees that compete for the limited water and soil nutrients will make more water and nutrients available for the remaining trees. Thinning also opens the stand’s crown canopy, making more light available for the remaining trees. The increased water, nutrients, and light that result from thinning increase photosynthesis in the remaining trees. More food is produced making more carbohydrate available for new cell formation and growth. After competition begins and the stand develops all crown classes, removing only intermediate and suppressed trees may not significantly reduce the competition faced by the larger dominant and co-dominant trees. Suppressed trees, in particular do not compete significantly with larger trees. Intolerant species (pines) require nearly full sunlight to thrive and grow. A successful low thinning removes all suppressed, most intermediates, many co-dominants, and even some dominant trees (Emmingham 1983).

The effects of fuel treatments on tree based carbon storage are currently being studied. Healthy forests play an important role in carbon sequesterization. Studies indicate that “in wildfire-prone forests, tree-based C stocks were best protected by fuel treatments that produced a low-density stand structure dominated by large fire resistant pines (Hurteau 2009). Average stand diameters increase significantly following thinning as smaller diameter trees are removed in favor of retaining larger trees. Concentrating removal on the smaller diameter trees also reduces fuel ladders and susceptibility to fire loss as average residual diameters and fire resistance increases. Biomass and follow-up treatments to remove submerchantable trees and brush will further reduce stress on the remaining stand. Where choices exist, more fire resistant pines would be favored over fir and incense cedar as leave trees. In most areas, stand composition following treatment

will consist of a greater percentage of more fire and drought resistant ponderosa and sugar pine as recommended in the North paper (2009). Although existing stand composition averages about 40 percent pine and sugar pine, 39 percent incense cedar, 15 percent white fir, and 6 percent oaks, it is estimated that 75 percent of the trees to be removed will be incense cedar, 10 percent will be white fir and 15 percent will be ponderosa and sugar pine. Thirty (30) inch harvest tree diameter limitations dictated by the SNFPA 2004 ROD will, in many areas, result in basal area retention levels in excess of proposed residual basal areas. In some cases in pockets of larger trees, no trees will be harvested. In these types of thinnings, the smaller size of the product to be removed makes harvest operations much more expensive than those where larger trees are removed.

Thinning to the proposed basal areas will result in increased diameter growth and crown expansion on the remaining trees as the residual trees respond to reduced competition. Since increased diameter growth will occur over fewer stems per acre, substantial increases in diameter will result. Repeated thinning will result in larger diameter, taller, healthier crowned trees over much shorter time frames than in unthinned stands. Shade intolerant pines and oaks will be retained in a more vigorous condition as a result of more available sunlight due to reduced competition. As the diameters of the residual trees become larger, they will become better able to survive a fire should one occur. Thinning is an effective technique for creating stands that more closely represent those present prior to railroad and other extensive logging and the exclusion of fires during the 20th Century.

Biomass, hand and mastication thinning and release of natural stands/aggregations of conifers and plantation trees generally less than 10 inches dbh would be undertaken as part of this proposal. These thinned aggregations would occupy large and small openings surrounded by larger trees as described in the North paper (2009). Depending on tree size these stands would be thinned to around 150 to 200 leave trees per acre. Hand thinning slash concentrations would generally be tractor piled and piles burned. Slash concentrations on steeper slopes would generally be hand piled and burned. Areas of only light slash (10 to 20 tons per acre) would be lop and scattered to 18 inches. Stand hetrogenity would be maintained through retention of these precommercially thinned clumps as well as untreated clumps on steeper slopes, the more dense clumps of larger diameter trees, SMZs, archaeological sites, and the two to three untreated larger oaks per acre.

Some underburning is proposed as a fuels reduction and understory management treatment within the proposed project boundaries. Underburning should only be done in portions of those stands with larger, more fire resistant residual trees and fairly light slash concentrations. Where scattered heavy slash concentrations are present, some piling of slash may need to be done prior to underburning. Due to the location of much of the proposed underburning, it is anticipated that late fall and early winter (after wetting rains) as well as early spring underburning may be possible. Late spring burning should not be attempted due to the high susceptibility of new growth to heat damage. In most cases, areas that have been masticated should not be underburned. Brush seed requires heat scarification to germinate; underburning will only help germinate brush seed present in the soil. Since white leaf manzanita is a non-sprouting species, in those areas where large white leaf manzanita has been masticated below the lowest live limb, reestablishment of manzanita brushfields would mostly occur through germination of manzanita seed. The masticated mulch layer covering the ground will reduce soil temperatures which will assist in keeping brush seed dormant and reduce the likelihood of brushfield reestablishment. The fuels officer and silviculturist should field coordinate all areas to be underburned prior to undertaking underburning.

Indirect and Cumulative Effects

Within HRCAs (Home Range Core Areas) and Old Forest Linkages the aim as stated in the SNFPA 2004 is to retain 60 percent or greater canopy cover, where available. (The intent of the Sugar Pine project is to retain canopy cover of 60 percent or greater in CWHR 4 and 5 size classes where it presently exists.) Within those portions of Spotted Owl and Goshawk PACs (Protected Activity Centers) where thinning is proposed, the aim is to retain 70 percent or greater canopy cover, where available.

In addition to the denser canopy cover proposed for PACs and Old Forest Linkages, groups or patches of five or more larger trees, generally 30 inches and larger, are planned to be retained through the project area. These small groups will have residual basal areas of 240 ft^2 or more for mixed conifer and 210 ft^2 or more for pine and in many instances may reach 300 to 400 ft^2 per acre. Approximately 2 to 3 black oaks 20 inches dbh and larger per acre would also have a 35 foot buffer, measured from the bole, around them where no fuels treatment would occur.

Retention of these higher basal areas to provide a more dense canopy cover will result in not fully meeting the silvicultural objectives for maintaining or improving forest health. The impact will not be as great in mixed conifer and fir stands as it will be in pine. Retaining 60 percent or greater basal area in pine stands leaves them at a level where stand density index studies have shown them to be susceptible to insect attack. Pine stands left at 70 percent or greater will remain at SDI max levels of 50 percent or greater (SDI 400 or more) and will be highly susceptible to insect attack. Oliver 1995, stated that a SDI 365 (200 ft^2 per acre), defines the threshold for a zone of imminent bark beetle mortality where pine stands suffer large losses from bark beetle epidemics. These losses can equal or exceed periodic growth. Subsequent growth of these stands will add further to the problem. Sufficient thinning will occur in some of the proposed scattered clumps to provide a short term benefit to stand vigor while in other clumps little, if any, thinning will occur resulting in a continued decline in clump vigor. Pine clumps left at these higher basal area retention levels will continue to be at a very high risk of loss due to insect, disease, competition, and/or drought induced mortality. A 2004 report found that plots infested by mountain pine beetle had significantly higher total basal area, ponderosa pine basal area, stem density and stand density index (Fettig 2007). Heavily stocked pine clumps attacked by insects have the potential to serve as infection centers for increased mortality in the surrounding pine stands as insect populations build and move into adjacent stands. To maintain more vigorous, drought and insect resistant stands, a shorter reentry period will be needed. The reentry time frame within HRCA, PAC, and Old Forest Linkage pine stands and these more heavily stocked clumps will likely be reduced by 5 or more years.

Since the vast majority of the crown covers and ground cover will remain in place following thinning operations, properly conducted thinning has only a minor short term affect on the environment. Leave trees will continue to contribute needles as well as small branches to the forest floor. Little soil movement and little, if any, increased runoff should occur as a result of this entry. Standard Streamside Management Zones will be maintained with any thinned trees being endlined out of the SMZs. Therefore, stream course stability will not be adversely affected. Long term affects will be to maintain or increase growth and vigor of treated stands, accelerate development of old forest characteristics in plantations, and improve the protection of human communities from wildland fires as well as minimize the spread of fires that might originate in urban areas, and reduce the threat of wildfire burning into and significantly damaging Nelder Grove. Over the past fourteen years, the district has planned and completed several projects, treating several thousand acres, similar to the proposed action. Canopy cover retention following

harvest has met or exceeded expectations. Residual crowns have rapidly filled in openings created by harvest treatments.

In addition to the benefits obtained through density management several other benefits have been noted in treated stands. Several studies have shown that in addition to increasing residual tree vigor, increasing temperatures and windspeeds are common in recently thinned stands. This may accelerate development of certain bark beetle species and force them to overwinter in stages that are more susceptible to freezing or cause turbulences that disrupt pheromone plumes used for recruiting conspecifics during initial phases of host tree colonization (Fettig 2008). Moderate thinnings may result in less potential extreme fire behavior compared to unmanaged stands. Greater fuel depths, mid–flame wind speeds and lower fuel moistures in heavily treated stands (>60 percent basal area reduction) might increase potential fire behavior compared to unmanaged stands. Thinning followed by sufficient treatment of surface fuels usually outweighs changes in fire weather factors (wind speed and fuel moisture) resulting in an overall reduction in expected fire behavior (Jenkins, et al 2008). Thinning followed by tractor piling and burning or whole tree yarding have been shown to be effective in reducing fire severity under severe fire weather conditions. Thinning from below where the largest trees are retained within the stand contributed to increased fire resistance (Stephens 2009). Thinning makes fire suppression more efficient. Once heavy fuels are removed, the residence time (duration) of the fire is reduced, often resulting in a non-lethal surface fire (Fitzgerald 2005). The thinning proposed within the Sugar Pine project is designed to reduce existing basal area by generally 30 percent or less. Biomass and post sale treatments are designed to remove fuel ladders as well as slash concentrations. This relatively light level of thinning should both realize the benefits of thinning stands to reduce the adverse effect of bark beetles while reducing expected potential fire behavior.

Alternative 3

This alternative is the same as Alternative 2 except that within the Fisher den buffer only fuel ladder removal and precommerical thinning will be undertaken.

Direct Effects

Except for the Fisher den buffer, the effects of thinning will be the same as described under Alternative 2. Within the Fisher den buffer (mostly involving treatment area T-4) very little to no density management will occur. Fuel ladder removal will be concentrated on suppressed and some intermediates. Few, if any, co-dominant trees would be removed. Table 40, Appendix D displays a sampled data comparison of existing to proposed action conditions for treatment area T-4, the predominant area affected by the Fisher den buffer. Except for some intermediate trees greater than 10 inches dbh with green crowns growing to within 10 feet of the ground, few trees greater than 10 inches dbh would be removed. It is estimated that within this buffer area only about 74 trees per acre would be removed instead of the proposed 159. One-hundred and forty-two (142) trees would remain instead of 57. A large percentage of these additional trees would be fire prone incense cedar. The average stand diameter within the buffer would increase only slightly. Of the existing 320 ft^2 of basal area sampled, 310 ft^2 would remain in the stand following treatment. This compares to 190 ft^2 that would be remaining under Alternative 2 (The prescribed leave basal area for this pine stand is 150 to 180 ft^2 per acre—normal stocking is 270 to 290 ft^2 per acre).

As stated previously, Smith (1962) stated that removal of only intermediate and suppressed trees results in “little more than the salvage of trees which will inevitably die”. Emmingham (1983) stated that a successful thinning from below requires the removal of many codominants as well as most intermediates and suppressed trees. Fuel ladder removal alone would not remove sufficient

competition to meet density management objectives. Failure to remove some of the co-dominants and intermediates growing into the bottom portion of the co-dominant layer of the stand will not create openings in the canopy to provide room for crown expansion of the residual trees. Shade intolerant oaks and pines will not be able to benefit from increased light and rates of photosynthesis provided by openings created in the canopy cover.

Indirect and Cumulative Effects

Except for the Fisher den buffer, the indirect and cumulative effects of thinning will be the same as described under Alternative 2. The indirect and cumulative effects for density management for the Fisher den buffer will be the same as in the No Action Alternative. Post treatment stocking levels within the buffer would be too dense to withstand the stresses of drought and climatic variances within the Fisher den buffer.

Alternative 4

This alternative proposes to only remove fuel ladders and pre-commercially thin throughout the treatment areas.

Direct Effects

Very little to no density management would be accomplished with this alternative. Fuel ladder removal would be concentrated on suppressed and some intermediates. Few, if any, co-dominant trees would be removed. (Table 37 in Appendix D displays a sampled data comparison of existing to proposed action conditions.) Except for some intermediate trees greater than 10 inches dbh with green crowns growing to within 10 feet of the ground, few trees greater than 10 inches dbh would be removed. Ninety (90) to 100 per cent of the existing basal area 5 inches dbh and larger would remain. Two to three times as many trees 5 inches dbh and larger would remain compared to Alternative 2. The percentage of fire prone incense cedar and fir would remain close to existing. The average stand diameter would increase only slightly. Shade intolerant pine and oaks would become less vigorous and continue to drop out of the stands. Post treatment stocking levels would be too dense to withstand the stresses of drought and climatic variances.

As stated previously, Smith (1962) stated that removal of only intermediate and suppressed trees results in “little more than the salvage of trees which will inevitably die”. Emmingham (1983) stated that a successful thinning from below requires the removal of many co-dominants as well as most intermediates and suppressed trees. Fuel ladder removal alone does not remove sufficient competition to meet density management objectives. Failure to remove some of the co-dominants and intermediates growing into the bottom portion of the co-dominant layer of the stand will not create openings in the canopy to provide room for crown expansion of the residual trees. Shade intolerant oaks and pines will not be able to benefit from increased light and rates of photosynthesis provided by openings created in the canopy cover. This alternative does not meet the purpose and need for density management emphasized in the SNFPA, 2004 decision and being examined as a part of this project.

Indirect and Cumulative Effects

The indirect and cumulative effects for density management for this alternative will be the same as in the No Action Alternative. Post treatment stocking levels within the buffer would be too dense to withstand the stresses of drought and climatic variances.

Fire/Fuels

Introduction

Presettlement fire strongly influenced the structure, composition and dynamics of most Sierra Nevada ecosystems. Many species and most communities show clear evidence of adaptation to recurrent fire, further demonstrating that fire has long been a regular and frequent occurrence. This is particularly true in the chaparral and mixed conifer communities, where many plant species take advantage of or depend on fire for their reproduction or as a means of competing with other biota. In many areas frequent surface fires are thought to have minimized fuel accumulation, keeping understories relatively free of trees and other vegetation that could form fuel ladders to carry fire into the main canopy (USDA-FS 1996).

Forest structure and species composition in many western U.S. coniferous forests have been altered through fire exclusion, past and on-going harvesting practices, and livestock grazing. The effects of these activities have been most pronounced in seasonally dry, low and mid-elevation, coniferous forests that once experienced frequent, low to moderate intensity fire regimes. Increased stand density, decreased overall tree size, and increased surface fuel loads are well documented for many forests of this type (Stephens, S. et al. 2009). Conifer stands generally have become denser, mainly in small and medium size classes of shade-tolerant and fire-sensitive tree species (USDA-FS 1996). These changes concern fire managers because the increased fuel loads and altered forest structure have made forest vulnerable to fire intensities and severities outside of the desired conditions and outside of historic fire regimes for these ecosystems. Changing climates in the next several decades may further complicate fire management by increasing temperatures and fire season length (Stephens, S. et. al. 2009). Fires now occur less frequently and cover much less area, but are likely to be large and severe when they do occur (USDA-FS 1996).

Fire represents both one of the greatest threats and one of the strongest allies in efforts to protect and sustain human and natural resources in the Sierra Nevada. Residents and visitors alike are well aware of the threats posed by summer wildfires. A growing density of homes and other structures coupled with the increased amount and continuity of fuels resulting from twentieth-century fire suppression have heightened concern about threats to life and property, as well as the health and long-term sustainability of forests, watersheds, and other natural resources. Yet fire has been an integral part of the Sierra Nevada for millennia, influencing the characteristics of ecosystems and landscapes. Today, State, Federal and local agencies put enormous resources into efforts to reduce fire occurrence while at the same time advocating the need to use fire to promote healthy ecosystems. The challenge faced is how to restore some aspects of a more natural fire regime while at the same time minimizing the threat wildfire poses to human and natural resources and values (USDA-FS 1996).

Affected Environment

The Sugar Pine Adaptive Management Project area encompasses five distinctive vegetation complexes. These include: (1) conifer plantations, (2) young (90 to 110 year old) mixed conifer stands, (3) mixed chaparral stands, (4) white and red fir conifer stands and/or (5) a combination of these. These vegetative complexes are results of various processes including wildland fires, effective fire suppression efforts, turn of the century timber harvesting and reforestation efforts.

Fire History

This area has a history of large fire occurrence. On September 10, 1922 a fire starting in the area of Sugar Pine occurred when the Madera Sugar Pine Lumber Company sawmill caught on fire and burned towards the Westfall area. By the time containment was reached, a total of 540 acres had been consumed. In 1924, three fires burned around the Sugar Pine Community. One fire burned just south of present day Westfall Fire Station below Highway 41, this fire was approximately 160 acres in size. To the north and west of Sugar Pine a fire originating in the vicinity of Happy Camp along Highway 41 burned up to the private property of the Yosemite Mountain Ranch. This fire was contained at 800 acres. To the east of Sugar Pine along road 5S18 (Dillon Orchard Road) a fire burned 106 acres before being contained.

Tables 26, 27, and 28 show the Fire History Records (fires >100 Acres) within and outside of the Sugar Pine Adaptive Management Project area (henceforth known as the Sugar Pine Project). Map 1 in Appendix A of this document shows the approximate perimeters of these fires and their proximity to the community of Sugar Pine and the project area.

Table 26. Fire History within the Project Boundary

Year	Size/Acres	General Location
1922	540	Into Sugar Pine Community
1924	800	North West of community/In Yosemite Mtn. Ranch
1924	160	West of Community
1926	106	East of Community

Table 27. Fire History Outside of the Project Boundary (Generally South of Sugar Pine)

Year	Size
1917	139
1920	99
1930	701
1934	304
1942	359

Table 28. Fire History within a 4-mile radius of Sugar Pine

Year	Size
1911	162
1917	2,236
1917	1,159
1924	10,310
1928	21,194
1934	304
1942	359
1958	803
1957	647
1959	11,076
1961	43,330

Logging

Heavy railroad logging entries (1900 through 1931) in the Sugar Pine and Nelder Grove area coupled with fire exclusion since the 1920s have resulted in development of dense fuel ladders. These consist of understory layers of fir and incense cedar beneath young growth stands of ponderosa pine, and sugar pine. Also in many of the pine plantations, incense cedar and white fir and brush have seeded in beneath the canopy, creating significant fuel ladders.

Fire Behavior in Current Fuel Loading

The Sugar Pine Adaptive Management Project (hence forth known as Sugar Pine Project) area has three dominant arrangements of fuels that influence fire behavior. These are: ground, surface and crown fuels. Ground and surface fuels can be described utilizing the Intermountain Fire Science Laboratory (IFSL) Fuel Models (Anderson 1982) and Scott and Burgan fuel models (2004) for estimating fire behavior. This is used to aid in describing the type and average amount of fuel given a particular vegetation type and the prediction of the type of fire behavior expected under certain weather and topographic conditions. Crown fuels are generally described in relationship to the density of crowns (canopy bulk density) and their height above the surface fuels (canopy base height).

Surface Fuels

Ground and surface fuels within the Sugar Pine Project area can be described by using the IFSL Fuel models, IFSL Fuel Model 6 (intermediate brush) best describes the surface and ground fuels in plantations, mixed conifer stands and mixed chaparral areas.

In areas within plantations where bear clover has re-established itself with minimal amounts of dead natural fuel accumulations, an IFSL Fuel Model 2, Timber (grass and understory) is used.

The ground and surface fuels within the mixed conifer stands that do not have brush as the main understory component fall into three IFSL Fuel Models 9, 10 and 12. The difference between these three fuel models comes from the increasing amounts of ground and surface fuels. IFSL

Fuel Model 9 has the lightest amount of ground and surface fuels associated with it and is used to describe the conifer stands in Sugar Pine Project area that have not started to deteriorate from drought stress and/or over crowding and the trees have not begun to fall on their own. This fuel model would also describe where there are large areas where small saplings and suppressed trees have begun to fill in the understory of larger trees. Surface fuel loadings in the Sugar Pine Project area that are representative of IFSL Fuel Model 9 average between 3 and 10 tons per acre.

IFSL Fuel Model 10 and 12 are used to describe those conifer stands where natural fuel and activity generated accumulations of ground and surface fuels are beginning to increase. These surface fuels are of larger size, mostly 3 or more inches in size and can increase the intensity of surface fires within the area. These fuels include not only the branches and needles of fallen trees, but also include the boles, increasing the tons per acres of natural fuels on the ground rapidly. Surface fuel loadings in the Sugar Pine Project area that are representative of IFSL Fuel Model 10 average between 12 and 25 tons per acre. Surface fuel loadings that are representative of IFSL Fuel Model 12 average between 25 and 40 tons per acre.

Crown Fuels

The crown fuels in the Sugar Pine Project area can be described in two ways; (1) crown fuels that can lead to the propagation of a crown fire and (2) crown fuels available to sustain a crown fire. There are two elements that need to fall into place for a crown fire to start and for it to sustain itself, fuel ladders (vegetation that “stair-steps” up in height and can allow a fire to reach the crowns of trees) and canopy density (in simple terms, how close together individual tree crowns are, usually given as a percentage of space taken up by the tops of trees).

In the Sugar Pine Project area, fuel ladders are heavy and continuous, consisting of natural regeneration of conifers (mainly white fir and incense cedar) and in some areas regeneration of conifers and brush. These fuel ladders start at the surface layer and have grown to the point of having a continuous “stair-step” of available fuels into the bases of the canopy trees.

The canopy fuels in the Sugar Pine Project area are varied from open to heavily closed (approximately 100% canopy closure). Areas where there is a combination of heavy, continuous fuel ladders and canopy closure is closed (interlocking of crowns in the canopy) the potential for initiation and sustainability of a crown fire is the greatest.

Wildland Urban Intermix (WUI)

Communities (wildland urban intermix zones) within and surrounding the project area have been rapidly developing over the last several years. The community of Sugar Pine is encompassed by the project area with scattered residences and businesses along the Highway 41 corridor. To the north is the community of Fish Camp, with Teneya Lodge (popular visitor destination outside of Yosemite National Park) directly adjacent to the project area and Wawona in Yosemite National Park. South of the Sugar Pine Project area lies the community of Cedar Valley. Farther south lays the community of Oakhurst. To the east, lies the Nelder Grove Historical Area of giant sequoia. With the continuity of the fuels within the Sugar Pine project area, a wildland fire originating from along Highway 41 or Cedar Valley area, under the right conditions, has the potential to spread northward or eastward to the communities of Sugar Pine, Fish Camp, Yosemite National Park and/or Nelder Grove.

Desired Condition

The SNFPA ROD, 2004 establishes a desired condition for each land allocation. In particular, the desired condition for each land allocation incorporates how and what type of vegetation

complexes are desired for each. These are referenced in short and long term conditions and are influenced by the temporal and spatial influences of fire. With this in mind, the land allocations and their specific desired conditions used in this report include:

Wildland Urban Interface

Defense Zone (USDA-FS 2004; page 40)

- Stands are fairly open and dominated primarily by larger, fire tolerant trees.
- Surface and ladder fuel conditions 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.

Threat Zone (USDA-FS 2004; page 41)

Under high fire weather conditions, wildland fire behavior in treated areas is characterized as follows:

- Flame lengths at the head of the fire are less than four feet;
- The rate of spread at the head of the fire is reduced to at least 50 percent of pre-treatment levels;
- Hazards to firefighters are reduced by managing snag levels in locations likely to be used for control prescribed fire and fire suppression consistent with safe practices guidelines;
- Production rates for fireline construction are doubled from pre-treatment levels; and
- Tree density has been reduced to a level consistent with the site's ability to sustain forest health during drought conditions.

Fuels treatments outside of the WUI and within other land allocations are to establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior (USDA-FS 2004; pages 45-48). There are specific means and conditions by which treatments can be conducted within some land allocations because of maintaining habitat needs as well as perpetuating such conditions (i.e. old forest emphasis areas).

Alternative 1 – No Action

Under Alternative1, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including: underburning, plantation maintenance, cattle grazing, recreation, and recreation residences.

Under Alternative 1 there would be no thinning; precommercial, commercial and/or biomass, accomplished. Fuel ladders and competition between trees would not be reduced and/or removed. Forest health in the area will continue to decline. No connection and augmentation of fuel treatments within and adjacent to the Wildland Urban Interface would be completed. No fuelbreak maintenance work would be completed. Aerial fire suppression would not support ground forces due to the inability of retardants to reach ground fuels because of closed canopy cover.

Direct Effects

Natural fuel accumulations would continue to increase as more trees begin to succumb to overcrowding, drought, insect and pathogens. This would increase the amount of ground and

surface fuels within the area. This increase in ground and surface fuels would gradually begin to shift the potential fire behavior in the area, to a more severe stature if a wildfire were to start. This increase would be to a more severe surface fire as the type of fuels changed from branches and needles (0 to 1 inch material) to the larger size material (3 or more inches). This change is best represented by fuel model changes or conversions. Brush covered areas would gradually become older and more decadent, converting from an IFSL Fuel Model 6 into an IFSL Fuel Model 4. Mixed conifer areas that begin as IFSL Fuel Model 9 would convert to IFSL Fuel Model 10. As accumulated natural surface fuel loadings increased, a further conversion from IFSL Fuel Model 10 to IFSL Fuel Model 12, similar to that of a moderate slash fuel loading could occur in some areas. IFSL Fuel Model 2 is used to represent the surface fuel conditions existing in some conifer plantation. Under Alternative 1, this would not change, but additional accumulations of larger diameter branch wood, twigs and perhaps boles of trees could increase the average tons/acre of surface fuels, increasing the fireline intensity and resistance to control. Firefighters with handtools or water from fire engines would become less effective. Crown fire potential would also remain high because none of the elements needed to propagate and sustain a crown fire would be removed (fuel ladders and canopy density). Because of the increased amount of surface fuels and the increased fire behavior associated with them, these potential crown fires would have the potential to propagate over a larger area. Tables 29 and 30 show the indicators for current existing conditions and those associated with the conversions in IFSL Fuel Models under Alternative 1.

Table 29. Indicators for IFSL Fuel Models of Brush Covered Areas

Indicator	Existing	Converted
Fuel Model	6	4
Average Rate of Spread (ch/hr)	24.8	91.6
Average Flame Length (feet)	5.8	22.9
Average Fireline Intensity (Btu/ft/s)	258	5131
Crown Fire Potential (transition and type)	Yes; Crowning	Yes; Crowning
Resistance to Control (low, mod., high)	High	High
Average Fuel Loading (tons/acre)	6.0	13.0
Average Mortality (%)	N/A	N/A

It is assumed that mortality in the brush species would be from stand replacing (100%) or patchy dependent on the percent cover of the brush. For mortality to occur in brush there need only be enough fire to girdle the main stem. With the predicted fire behavior, as shown above, it is anticipated that in Fuel Model 6, as currently exist, there would be mortality, but not as great as in Fuel Model 4, because of the lower amount of dead woody material found on the brush.

Table 30. Indicators for IFSL Fuel Models in Timber Covered Areas

Indicator	Existing	Existing	Converted	Converted
Fuel Model	9	2	10	12
Average Rate of Spread (ch/hr)	10.3	48.3	10.3	16.2
Average Flame Length (feet)	3.5	7.8	6.0	9.6
Average Fireline Intensity (Btu/ft/s)	84	500	282	781
Crown Fire Potential (transition and type)	Yes; Crowning	Yes; Crowning	Yes; Crowning	Yes; Crowning
Resistance to Control (low, mod., high)	Moderate to High	Low to Moderate	High	High
Average Fuel Loading (tons/acre)	3.5	4.0	12.0	34.6
Average Mortality in White Fir / Ponderosa Pine (%)	35 / 22	97 / 94	79 / 65	99 / 97

Tables 29 and 30 above tables give an indication of what type of fire behavior could be expected if a fire were to occur within these fuel beds as they currently exist and in the anticipated fuel beds into the future with no management action taken. Because of the variability in the three facets needed to predict fire behavior; fuel, weather and topography that exist within the Sugar Pine Project area, there would be variations in the conditions and results of wildfire. On northern aspects, conditions would be expected to be cooler than southern aspects, lending to slightly slower and slightly less intense fires. Lower fuel loadings could produce slower rates of spread and intensities than predicted above. There are conditions that could produce higher rates of spread and intensities than in the above tables as well. These would include increased slopes, wind conditions, greater surface fuel loadings (both small and large down-woody debris) and increased density of ladder fuels.

Indirect and Cumulative Effects

Past, present and reasonably foreseeable actions, as listed in the project file for the Sugar Pine Project area, along with fire management policy of full suppression at the smallest size (97 percent of all fires will be controlled at 10 acres or less from Sierra NF LRMP (USDA-FS 1991, 1996) have contributed to the current existing condition for the Sugar Pine Project area and are used to depict the existing condition and the resultant fire behavior within the project area.

Fire Suppression / Fire Use

As surface fuels continue to accumulate naturally, with no additional management actions, suppression efforts will gradually become more difficult, whereby direct attack could no longer be used in suppressing a fire, but have to be changed to more indirect tactics, whereby more area has the potential to be affected by fire, in some cases high intensity and more severe fire. With the increases in fire behavior generated by these surface fuel changes, fire suppression forces would have higher resistance to control (the relative difficulty of constructing and holding a control line as affected by resistance to constructing line due to fuel loading and by fire behavior), and aerial retardants would be less effective due to closed continuous canopy. If fire were to start in or burn into the Sugar Pine Project area, ground and aerial initial attack operations as well as extended attack would become less effective and firefighter and public safety would be difficult to ensure.

Under Alternative 1, full suppression would continue to be the management direction for the Sugar Pine Project area. Because of the continued and potential increased threat to life and property, under Alternative 1, firefighting resources would focus strategies and tactics on reducing the impacts on communities, protecting infrastructure and private property as the highest priority followed by protection of natural resources.

Under Alternative 1, there would be very limited to no potential to allow fire to play its natural role on the landscape. The risk of escape and the consequential effects associated with utilizing fire without some form of management activity to reduce current surface fuel loadings and ladder fuels would be too great. Although prescribed fire could be implemented under more controlled conditions than those conceivably present during the summer fire season, it would be a very narrow prescription window that could produce reasonable outcomes that would be beneficial versus detrimental. Just like wildfire, prescribed fire produces air quality concerns, risk of escape, potential negative impacts to resources (from control lines and fire itself), resource commitments and political and social impacts.

Fire Effects

Fire influences many portions of a fire dependent ecosystem by either its presence or even its absence. Forest stand structures, wildlife habitat, aquatic communities, watersheds, plant communities and soil conditions, to name a few can be influenced. Without frequent fire to clean the understory of stands, excessively dense stands lead to drought stress and bark beetle outbreaks, resulting in wide spread mortality of trees in many areas and the potential for extensive mortality. This leads to a large increase in the amount and continuity of both live and dead forest fuels, resulting in a substantial increase in the probability of large, severe wildfires (Weatherspoon, C.P. 1996). These are directly correlated to the conversions of IFSL Fuel Models discussed in the direct effects section.

With increased rates of spread, flame lengths, and fireline intensities there is potential for greater fire effects to occur. Because of existing changes in tree species composition, from fire resistant to fire susceptible, tree mortalities would increase with small incremental changes in wildfire intensity. This, in combination with drought or insect/pathogen induced mortality in overstocked stands, could greatly increase the amount of surface fuel loading, thus increasing fire behavior and intensity of subsequent wildfires. Under Alternative 1, there would be no reduction in surface and ladder fuels, to raise mean canopy base heights and/or decrease canopy bulk densities as has been suggested in the desired condition for creating fire resilient stands. Vertical continuity of fuels from the forest floor to the crowns of overstory trees would be present and with sufficient radiant/convective heat could produce crown fire. Some studies and models, however, suggest a crown fire entering a stand is rarely sustained (i.e., sustained only under extreme weather conditions) (North, M., et. al. 2009). Calculated and predicted crown fire potential (see Tables 29 and 30) show that conditions are present in the Sugar Pine Project area to produce the potential for crown fire. This could be in the form of torching single trees, groups of trees and/or active crown fire dependent on weather, fuels and topography of where the fire were to occur.

Crown fires remove much or the entire tree canopy in a particular area, essentially resetting the successional and growth processes of stand and forests. These fires typically, but not always kill or temporarily reduce the abundance of understory shrubs and trees. Crown fires have the largest immediate and long-term ecological effects and the greatest potential to threaten human settlements near wildland areas (Graham, R., et. al. 2004). For wildlife species dependent on diverse forested landscapes (heterogeneity) and old forest characteristics for habitat, this successional “set-back” could pose negative consequences.

Although crown fires would be considered of higher consequence of negative effects, surface and ground fires with higher intensities similar to those predicted and anticipated in this alternative, can also have negative impacts. While surface fires can reduce vegetation and woody, moss, lichens and litter strata, ground fires that consume large amounts of woody fuels and organic soil horizons can produce disproportionately large amounts of smoke. Ground fires reduce the accumulation of organic matter and carbon storage and contribute to smoke production during active fires and long after flaming combustion has ended. These fires can also damage and kill large trees by killing their roots and the lower stem cambium. Because ground fires are often of long duration, they may result in greater soil heating than surface or crown fires, with the potential for reducing organic matter, volatilizing nutrients, and creating a hydrophobic layer that contributes to erosion. Areas where the ground cover is removed and severely burned will likely see decreased infiltration of water, increased surface runoff and peak flows, and the formation of pedestals, rills and gullies (Graham, R., et. al. 2004).

Depending on the setting (in particular topography and soil), perennial streams downstream from fires can be impacted by large volumes of sediment. Depending on the recovery of the hillslopes, these fire effects can be long lasting, and relatively little can be done to stop the problem. Large amounts of sediment can be delivered to reservoirs, reducing water storage capacity and potentially affecting fish and macroinvertebrate habitat (Graham, R., et. al. 2004).

Alternative 2 – Proposed Action

Under Alternative 2, the development of Strategically Placed Area Treatments (SPLATs) would occur. Additional areas would be treated to provide a defensible fuels profile near key transportation corridors and within the defense zone of the wildland urban intermix. In addition to those treatments needed to meet fire and fuels objectives, treatments would be created to reduce stand densities (basal area) to such a level as to improve the growth and vigor of remaining trees. Treatments included in this alternative are: thinning from below in conifer stands, either by pre-commercially, commercially, biomassing and/or mastication of vegetation (conifers) to reduce lower and mid- level canopy stand densities; mastication of brush and shrub patches; prescribed burning, both understory and piles; manual reduction and/or prescribed burning of noxious weed infestations; and prepare and plant failed conifer plantations.

Creating Fire Resistant Forests

Fire resistant forests combine fire resistant tree species suitable to a site in a spatial arrangement that discourages surface fires from moving to the crowns. Crowns are made more resistant to fire by reducing surface and ladder fuels as well as increasing the height of the base of the canopy.

Canopy Base Height (CBH):

- Is the lowest height above the ground at which there is sufficient canopy fuel to propagate fire (Van Wagner 1993);
- Is the average crown base height for the stand;
- Is the lowest 20th percentile of all crown base heights in the stand (Hoffman 2005, Fulé et al. 2001, 2002);
- The height at which a minimum bulk density of fine fuel (30 lb/acre/ft, 0.011 kg/m3) is found (Beukema et al,1997); and
- CBH is the lowest height above the ground at which there is sufficient canopy fuels to propagate fire vertically through the canopy (Scott and Reinhardt 2001).

Also decreasing the crown density and removing smaller trees while retaining larger more fire resistant trees reduces the risk of crown fire.

Table 31. Principles of Fire Resistant Forests

Recommendation	Physical Effects	Fire Advantage	Concerns
Reduce surface and ladder fuel	Reduces potential flame length	Fire control easier, less torching	Surface disturbance less with fire than other techniques
Increase canopy base height	Requires longer flame length to ignite tree crowns	Less torching	Opens under story, may allow surface wind to increase
Decrease crown density	Makes independent crown fire less probable	Reduces crown fire propagation	Surface wind may increase, surface fuel may be drier
Retain larger trees	Thicker bark and taller crowns	Increases survivability of trees	Removing only smaller trees is economically less feasible
Retain fire resistant tree species	Promotes trees most likely to survive fires	Reduces mortality from future fires	Repeated treatments may be necessary to promote desired trees

Source: Adapted from Agee 2002 by Graham et. al. 2004

The table above is displayed in this report to assist in demonstrating the types of treatments proposed to achieve the purpose and need of the Sugar Pine Project, the physical effects, fire advantage and concerns associated with each recommended means to affect fire behavior. The following associates the predicted fire behavior results of each level of treatment proposed by this and all action alternatives.

Direct Effects

Under this alternative, thinning from below, through biomass, precommercial and/or commercial means would focus first on the smaller trees for removal gradually moving through the lower canopy levels with the potential to remove trees within the mid-level canopy to reach a silviculturally-prescribed basal area and stocking level. Through the treatments in Alternative 2, the recommendations in Table 31 are accomplished by reducing surface and ladder fuels, increasing canopy base height, decreasing crown density, retaining larger trees and retaining fire resistant tree species.

Fuel Model Changes

Under Alternative 2, existing fuel model would be converted to another fuel model, typically a fuel model with lower surface fuel loadings and reduced fire behavior. In areas currently represented by IFSL Fuel Model 6, mastication would be used to convert it to an IFSL Fuel Model Timber/Understory (TU) 1. Mastication in effect does not remove the fuel from the site, but changes the structure of the fuel from a vertical orientation to a horizontal orientation. Small chips, shredded material and/or crushed fuels (dependent on masticator head) are left on site. A fuel model that represents an increase in fuel loading in the 10 and 100-hour time lag categories is needed to show this. TU1 is used as the base fuel model with increases in 10 and 100-hour fuel loadings to approximately 2 tons per acre each and the removal of live woody fuel loading to approximate this conversion.

In timbered stands represented as IFSL Fuel Model 9, there would be or no conversion to a different fuel model. In stands represented by IFSL Fuel Model 10, biomass and thinning from below would convert them to an IFSL Fuel Model 8 or 9, dependent on the overstory and surface fuels remaining. In some cases, a short-term conversion to an IFSL Fuel Model 12 may occur until post activity treatments were completed, then a conversion to an IFSL Fuel Model 8 or 9 would result.

The fuel model conversions shown are used to depict the conditions anticipated in the surface fuel bed changes as a result of the treatments proposed in this alternative. This alternative is also anticipated to raise canopy base heights, with the thinning or removal of ladder fuels from an average of 0 to 10 feet to an average of 20 feet. Canopy bulk density will also be decreased through the thinning of lower and mid-level canopies. It is estimated that, on average the canopy bulk density will be changed from 0.19 kg/m3 to 0.14 kg/m3 under Alternative 2.

Surface and Ladder Fuels

The removal and/or thinning of the lower canopy in effect removes the ladder fuels that can provide the means for surface fires to “climb” into the overstory canopy. In areas where there is a significant amount of ladder fuels present, biomass operations will be used to remove excess material. It is anticipated there would be small amounts of additional fuels added to the current surface fuel loading through this type of operation because the material would be taken in whole tree form to a landing for removal versus limbs/tops cut off and left within the stand (known as lop and scatter). In areas where brush species are the dominant vegetation cover, masticators will be used to in effect change the vertical continuity of the fuel. While mastication does not actually remove fuel from the area, it does change the structure from a vertically oriented fuel (ladder fuel) to a horizontal fuel potentially making fire suppression resistance to control lower and fire effects less in most cases. In areas where there are lower amounts of ladder fuels and/or smaller areas, mastication and/or hand cutting will be used to open or separate the lower canopy from the mid to upper level canopy. Typically, these areas have lower levels of surface fuels existing (smaller amount of trees/vegetation, less amounts of naturally accumulated or activity generated surface fuels).

Dependent on the type of harvest system used for removal of excess commercial-sized material, it is anticipated there may be a short-term increase in surface fuel loading or no significant increase. Whole-tree yarding, used as a harvesting system, can minimize the amount of activity generated fuels (Stephens, S. 2009). If whole tree yarding is not used, additional post harvest treatments will be needed to reduce surface fuel loadings that are in excess of 20 tons/acre (USDA-FS 2004). These post activity treatments would include dozer and/or hand piling and burning and/or broadcast/jackpot burning.

Fire Behavior / Fire Effects

Table 32 shows the predicted results of fuel model conversions anticipated with this alternative.

Table 32. Indicators for IFSL Fuel Models of Brush and Timber Covered Areas

Indicator	Existing	Existing	Existing	Converted	Converted	Converted
Fuel Model	6	9	10	12	TU1	9
Average Rate of Spread (ch/hr)	24.8	10.3	10.3	11.0	7.5	5.8
Average Flame Length (feet)	5.8	3.5	6.0	8.1	3.0	2.7
Average Fireline Intensity (Btu/ft/s)	258	84	282	531	63	47
Crown Fire Potential (transition and type)	Yes; Crowning	Yes; Crowing	Yes; Crowning	Yes; Torching	No; Surface	No; Surface
Resistance to Control (low, mod., high)	High	Low to Moderate	High	High	Low	Low
Average Fuel Loading (tons/acre)	6.0	3.5	12.0	34.6	6.0	3.5
Average Mortality in White Fir / Ponderosa Pine (%)	N/A	35 / 22	79 / 65	96 / 93	N/A	15 / 8

The above table gives an indication of what type of fire behavior could be expected if a fire were to occur within these fuel beds as they currently exist and in the anticipated fuel beds after treatments were to occur. Because of the variability in the three facets needed to predict fire behavior; fuel, weather and topography within the Sugar Pine Project area, there would be variations in the conditions and results of wildfire. On northern aspects, conditions would be expected to be cooler than southern aspects, lending to slower and less intense fires. Lower fuel loadings could produce slower rates of spread and intensities than predicted above. There are conditions that could produce higher rates of spread and intensities than in the above tables. These would include increased slopes, wind conditions, greater surface fuel loadings (both small and large down-woody debris) and increased density of ladder fuels.

Indirect and Cumulative Effects

Past, present and reasonably foreseeable actions, as listed in the project file for the Sugar Pine Project area, along with fire management policy of full suppression at the smallest size (97 percent of all fires will be controlled at 10 acres or less from Sierra NF LRMP (USDA-FS 1991, 1996) have contributed to the current existing condition for the Sugar Pine Project area and are used to depict the existing condition and the resultant fire behavior within the project area.

Fire Suppression and Fire Use

Alternative 2 in effect reduces ladder fuels which in turn increases canopy base height. Canopy density (in the form of canopy bulk density) is decreased through the thinning of the mid-level canopy, but to a small extent through the reduction in fuel ladders. These, in combination, reduce rates of spread, flame length, fireline intensity, resistance to control and the potential for a fire to transition into crown fires. If full fire suppression continues as the management strategy for unplanned ignitions within the project area, fire suppression resources will have an increased capacity to control fires at initial attack with minimized risk to their safety (and the public) and increased ability to keep these fires small in size with the use of direct attack tactics versus indirect tactics. Fires would typically drop from the crowns to the forest floor. Aerial fire fighting resources would be better able to penetrate the canopy to aid ground resources with reduced canopy density, even moderate amounts as an indirect effect of treatments in Alternative 2.

Design features used to minimize effects and/or retain habitat structures preferred by wildlife species such as; grouping of larger trees, oak retention with ladder fuels retained under them and Old Forest Linkages with limited treatments will have lower potential for loss since there will be treated areas between them and are not continuous. This would be similar to the variability in forest conditions produced by frequent fire (North 2009).

In utilizing mechanical treatments, as in Alternative 2, stand structures are modified quickly and more precisely than with prescribed fire alone (North 2009). Under this alternative, treatments are effective in breaking up the horizontal and vertical continuity of live fuels in the lower canopy layers and/or in effect pre-treating the stands to more readily allow prescribed fire to be re-introduced. Silvicultural cuttings can only partially substitute for fire (Weatherspoon 1996). This alternative allows increased potential to utilize prescribed fire as either a maintenance treatment and/or in conjunction with mechanical treatments as a follow-up process to achieve forest resilience. Fire could mimic the natural ecosystem functions of frequent low-to-moderate severity fire. Under this alternative, prescribed fire, whether burning of piles and/or broadcast burns can be implemented with less risk of escape, with a broader range of acceptable conditions and in some cases less impacts to air quality (Weatherspoon 1996).

Fire Effects

With the removal of what is considered the suppressed, intermediate and some co-dominates within a stand, the vegetation considered ladder fuels would be removed. Conifer species such as Ponderosa Pine and Sugar Pine, which are considered more fire resistant, would be favored to remain in a stand over shade tolerant and fire sensitive species, such as incense cedar and white fir. Incense cedar and white fir make up the largest percentage of conifers found in the understory of stands in the Sugar Pine Project area (based on sampled plot data). These species also tend to have increased susceptibility to wildfire as well tend to have limbs that stay closer to the ground providing increased ability to take surface fires into the crowns in the form of single tree torching or group torching. With species composition favored towards the more fire resistant, shade intolerant species and fire behavior modified, effects to stands (mortality) would be decreased.

As part of this alternative, treatments would be implemented to reduce surface fuels, where needed. In most cases, as been experienced in past projects similar to this alternative, these areas are not continuous over the entire treatment area. If a fire was to start in an area where these surface fuels have not been reduced, fire behavior would be increased (as represented by IFSL Fuel Model 12). The results of wildfire impacts on areas treated only with mechanical methods are mixed. Some burned with higher intensity, than those where mechanical treatments were followed by prescribed burning, though with lower severity than untreated control areas

(Stephens, S. 2009). The timing and sequence of these "clean-up" treatments are dependent on several factors, such as adequate funding and completion of harvesting operations. Those treatment areas closest to WUI will be treated first and then will progress into other areas from there. As stated earlier the surface fuel load changes would be largely based on harvesting system used. If whole-tree yarding is used, post treatment areas where natural fuel accumulations are above 20 tons/acre would be the areas where secondary treatment would be used. These are areas expected to be less (acres) in need of surface fuel reduction.

With reduction in fire behavior, the effects of fire on other ecosystem components would be reduced and perhaps enhanced. Many are resistant or often have favorable responses to low to moderate fire intensity and severity. The idea of preemptive work that restores historic fire regimes has not been widely discussed, considered, or used to address both the ecological and social issues surrounding fires and watershed resources. The same can be said for many of the wildlife species that live and depend on the forested ecosystem. At risk species, and the ecological functioning systems they depend on, cannot be sustained or recovered without the immediate and longer-term ecological functioning provided by fire. In Alternative 2, integrating fire and fuels management objectives and forest health restoration with at-risk species conservation and protection are made. This is needed to provide both the viability of human communities and at-risk species where both overlap (Sugihara, N., et.al. 2006).

Climate Change and Fire Severity Relationships

As stated earlier, weather (climate) has a large influence on fire behavior and is also the most difficult to predict. Associated with the purpose and need to reduce stand densities to levels where trees would be more resilient to drought conditions, reducing surface and ladder fuels to reduce wildfire intensity and spread, can also produce benefits in drought conditions. Research suggests global mean minimum temperatures may have already begun to rise. One effect of this change for western forests would be earlier spring melt of mountain snow packs. An analysis of western U.S. fire season length over the last 50 years suggests that during the last two decades, fires begin earlier in the spring and occur later in the fall possibly due to this trend in elevated nighttime minimum temperatures. Though there are variations in predictions and models, one point of consensus is that most agree the climate will become more extreme, suggesting oscillations between wet and drought conditions will be more common (North 2009).

Managing forests under these conditions will be challenging. In the face of uncertainty, adaptive strategies should focus on three responses; resistance (forestall impacts and protect highly valued resources), resilience (improve the capacity of ecosystems to return to desired conditions after disturbance), and response (facilitate transition of ecosystems from current to new conditions) (North 2009). All of these are focuses that Alternative 2 is attempting to address through its purpose and need for changes in forest structure capable of surviving climate changes and reduction in fuels to adapt fire behavior that occurs under current climate and ignition conditions (North 2009).

Alternative 3

Under Alternative 3, all treatment areas would be carried forward from Alternative 2, but in areas where there are known Pacific fisher den sites, treatments within associated den site buffer would include only those treatments needed to achieve fire and fuels objectives (treatment of surface and ladder fuels). All other treatment areas would continue to treat for both fire/fuels and forest health (stand density) objectives.

Direct Effects

Under Alternative 3, there would be no significant change in the direct effects from those listed under Alternative 2. There is a potential for a decreased amounts additive surface fuel loading within the known fisher den site area resulting from less conifers being removed. As stated in Alternative 2, resultant increases or decreases in surface loadings from harvesting operations are dependent on the type of harvesting operations that are used. By increasing canopy base heights and reducing surface fuel loadings, fire and fuels objectives are met.

Indirect and Cumulative Effects

Under Alternative 3, there would be no significant change in the indirect and cumulative effects from those listed under Alternative 2. There is a potential for aerial firefighting resources to be less effective in the Pacific fisher den site area with no reduction in mid-level canopy densities. Increased crown densities in the den site area would make it difficult for retardant and/or water dropping from helicopters to penetrate to the ground. In assuring the reduction in ladder fuels to raise canopy base heights from 0 to 10 to 20 feet and reducing surface fuel loadings, fire intensity and spread are reduced to desired condition levels and meet the fire and fuels objectives stated in the purpose and need of the project.

There is little to nothing is done to reduce forest stand densities within the Pacific Fisher den site area though with this alternative and could produce losses from drought induced mortality, insect and disease. Long term, these types of disturbances could induce increases in surface fuel loadings and/or increased snag levels producing conditions similar to those already existing in the project area with resultant fire behavior (intensity and spread rates) similar to those predicted in Alternative 1, with the exception of crown fire potential. It is assumed that with the reduction in ladder fuels, there would be increases in rates of spread, increase flame lengths, increased fireline intensity, and increased resistance to control, similar to that seen in IFSL Fuel Model 9 and/or 10 in Alternative 1, but this would be as a surface fire with potential for crown fire reduced and/or eliminated. Fire intensities could cause the potential for single or group tree torching because of the increased number of fire susceptible trees such as white fir and incense cedar left in the stand, but this is expected to be less than in Alternative 1.

Alternative 4

Under Alternative 4, all treatment areas would be carried forward from Alternative 2, but treatments would include only those needed to achieve fire and fuels objectives (treatment of surface and ladder fuels).

Direct Effects

Under Alternative 4, there would be no significant change in the direct effects from those listed under Alternative 2. As in Alternative 3 direct effects, there is a potential for a decreased amounts additive surface fuel loading within all “T” treatment areas resulting from less conifers being removed. As stated in Alternative 2, resultant increases or decreases in surface loadings from harvesting operations are dependent on the type of harvesting operations that are used. By increasing canopy base heights and reducing surface fuel loadings, fire and fuels objectives are met.

Indirect and Cumulative Effects

Under Alternative 4, there would be no significant change in the indirect and cumulative effects from those listed under Alternative 2. There is a potential for aerial firefighting resources to be

less effective in all "T" treatment areas with no reduction in mid-level canopy densities. Increased crown densities in the den site area would make it difficult for retardant and/or water dropping from helicopters to penetrate to the ground. In assuring the reduction in ladder fuels to raise canopy base heights from 0 to 10 to 20 feet and reducing surface fuel loadings, fire intensity and spread are reduced to desired condition levels and meet the fire and fuels objectives stated in the purpose and need of the project.

There is little to nothing done to reduce forest stand densities within the Pacific fisher den site area. This alternative could produce losses from drought induced mortality, insect and disease. Long term, these types of disturbances could induce increases in surface fuel loadings and/or increased snag levels producing conditions similar to those already existing in the project area with resultant fire behavior (intensity and spread rates) similar to those predicted in Alternative 1, with the exception of crown fire potential. It is assumed that with the reduction in ladder fuels, there would be increases in rates of spread, increase flame lengths, increased fireline intensity, and increased resistance to control, similar to that seen in IFSL Fuel Model 9 and/or 10 in Alternative 1, but this would be as a surface fire with potential for crown fire reduced and/or eliminated. Fire intensities could cause the potential for single or group tree torching because of the increased number of fire susceptible trees such as white fir and incense cedar left in the stand, but this is expected to be less than in Alternative 1.

Air Quality

Introduction

Although there are many sources that can and do influence air quality, such as stationary, area-wide, mobile and natural sources, the two that will be discussed in this section are the two that can be influenced the greatest in the Sugar Pine Adaptive Management Project; area-wide (prescribed fire) and natural sources (wildfires) and their effects.

Fire is an important part of California ecosystems, but it also produces combustion byproducts that are potentially harmful to human health and welfare. Carbon dioxide and water are the two products of complete combustion and generally make up 90 percent of the total emissions from wildfire. In incomplete combustion that occurs under wildfire conditions, smoke is composed of carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, and other organic compounds, nitrogen oxides, trace minerals, and several thousand other compounds. Particulate matter is the principle pollutant of concern to human health from wildfire smoke for the short-term exposures typically experienced by firefighters and the public. Studies indicate that 90 percent of smoke particles emitted during wildland burning are particles that less than ten microns in size (PM10), and about 90 percent of these are less than 2.5 microns (PM2.5). Hydrocarbons and nitrogen oxides from large wildfires contribute to increased ozone formation (which causes injury to plants) under certain conditions (Ahuja 2006). Emission factors are expressed in pounds of emissions per ton of fuel consumed. This in turns means the fuel loading and the combustion stage of a fire can be used to estimate the anticipated amount of emissions produced by the wildfire, whether it is a wildfire or a prescribed fire, but fuel loading estimation is one of the parameters that can introduce a major error in estimation of the emissions (Ahuja 2006).

There are two general strategies to managing wildfire smoke: (1) emission reduction and (2) emission redistribution. All pollutants except nitrous oxide are negatively correlated with combustion efficiency, so actions that reduce one pollutant result in the reduction of all. Optimal use of reduction techniques can reduce emissions by approximately 20 to 25 percent, assuming all other factors (vegetation types, acres, etc.) were held constant and land management goals were still met. Emission reduction techniques include reducing the area burned, reducing fuel loading, reducing fuel production, reducing fuel consumption, and scheduling burning before new fuel appears and increasing combustion efficiency (Ahuja 2006).

Emission redistribution is regulated by local and State air pollution control boards/districts by the designation of “burn days” or “no burn days”. Burns are to be conducted on burn days. This is often the most effective way to prevent direct smoke impacts to the public or sensitive areas. These “burn days” are typically during periods of good atmospheric dispersion (dilution of emissions) and when prevailing winds will transport smoke away from sensitive areas (avoidance) so that air quality standards are not violated. Typical strategies applied to achieve redistribution/avoidance of emissions include burning when dispersion is good, sharing the air basins, burning more frequently, burning smaller units, especially in non-attainment areas, and avoiding sensitive areas (Ahuja 2006).

Land managers and air quality regulators have and must continue to work together to better understand the effectiveness, options, difficulties, applicability, and trade-offs of emission reduction techniques. They are the key operators that can develop strategies leading to a reduction of smoke emissions (Ahuja 2006).

Affected Environment

The Sugar Pine Adaptive Management Project is within two air basins that are regulated by two air districts; San Joaquin Valley Air Pollution Control District (Madera County) and Mountain Counties Air Pollution Control District (Mariposa County). Each are responsible for implementing and regulating sources that degrade air quality and are responsible for meeting State and Federal air quality standards. The California Air Resources Board has oversight authority to monitor performance of district programs.

The physical features (topography) and climatology surrounding the Sugar Pine Adaptive Management Project area can lead to effects from wildfire and/or prescribed burning to occur within both the San Joaquin Valley air basin and the Mountain Counties' air basin. Smoke sensitive areas in or near Sugar Pine Adaptive Management Project area include: communities (Sugar Pine, Fish Camp, Oakhurst, etc.), infrastructure (schools, hospitals, etc.) and Class I airsheds (wilderness areas or in this case Yosemite National Park). Additional concerns are focused on the status of air basins in meeting Federal, State and local air quality standards.

Air quality in the San Joaquin Valley (Valley) is among the poorest in the State. The Valley experiences about 35 to 40 days per year where air quality exceeds Federal health-based standards for ground-level ozone and more than 100 days per year over the State ozone standard. Levels of airborne particulates exceed the Federal standard less than five times annually. The California standard is set at a lower and more protective level. The San Joaquin Valley exceeds the California limit an average of 90 to 100 days per year (SJVUAPCD 2003).

Currently the valley is Federally-classified as in severe non-attainment for the Federal ground-level ozone and particulate matter less than 10 microns in diameter (PM10) standard. Additionally, the Valley is classified as in severe non-attainment for the State's PM10 standard. Attainment status for PM10 was requested from the Environment Protection Agency (EPA) on April 25, 2006 (www.valleyair.org, 2006). Although Mountain Counties' air basin in Mariposa County is also considered in non-attainment for ozone 8-hour Federal standard (Ahuja 2006), San Joaquin Valley Air Pollution Control District regulations and rules associated with the use of fire are much more stringent.

Alternative 1 – No Action

Under Alternative1, current management plans would continue to guide activities in the project area. This includes all ongoing activities with existing decisions or permits that would not be changed if this alternative were selected including underburning, plantation maintenance, cattle grazing, recreation, and recreation residences.

Direct, Indirect and Cumulative Effects

No direct effects to air quality would occur under this alternative since no treatments would be completed outside of that which is already permitted or authorized.

Indirect and cumulative effects include the potential for unplanned ignitions and wildfires to occur in the area. The resultant smoke caused by these would have large amounts of emissions released and could potentially be of long duration. Values measured such as PM10 and visibility range used to determine the Health-Protective Value would be in the ranges assumed to be in the Unhealthy. Values associate with this rating are PM10 ranging from 176 to 300 $\mu g/m^3$ and visibility of 1.24 to 2 miles (considered moderate smoke conditions). This would be considered the lower of the Health-Protective Values a wildfire would produce, if it occurred in the area. It is anticipated that for short periods of time the values may rise to the levels considered Very

Unhealthy or perhaps Hazardous. The Statewide Emission Inventory in 2002 reported emissions (tons/day, annual average) from wildfires (Ahjua 2006) and is demonstrated in Table 33.

Table 33. Statewide Emission Inventory 2002 for Natural Sources-Wildfire

Emissions	Total Organic Gases	Reactive Organic Gases	Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	PM_{10}
Natural Sources: Wildfire	6,522	3,046	17,474	3,441	302	2,418

The high summer temperatures and light wind speeds that occur during the summer months, places a cap on valley air with no means for cleansing itself by dispersion or transport. Because of the poor air quality associated with the San Joaquin Valley Air Basin it does not take large amounts of additional emissions to degrade air quality into unhealthy ranges especially in the summer and fall months, where storm systems are less likely to occur and disperse smog and emissions. Emissions from a wildfire could potentially have long lasting impacts beyond the initial burning period because of this. Uncontrolled wildfires are clearly responsible for the most widespread, prolonged, and severe periods of air quality degradation (Sugihara, N. 2006).

Alternative 2 – Proposed Action

In this alternative, treatments are proposed to reduce surface, ladder fuels and some aerial fuels. This is proposed to occur through the use of mechanical methods as well as management ignited fire in the form of prescribed fires such as pile burning, understory burning and/or broadcast burning. Prescribed burn plans and smoke management plans are required prior to implementation of any type of prescribed burning. These include prescriptions or weather parameters that would provide acceptable results, including reduction in smoke impacts. Smoke management plans are written and approved by the local air districts. Prescribed burning is would occur on air district designated burn days when conditions are such that dispersal and transport are optimized. The effects analyzed are those that would result from the prescribed burning proposed by this alternative.

Direct Effects

The direct effects from prescribed burning (production of emissions through smoke production) are generated by the number of acres to be burned and the surface fuel loading of the area being burned. In this alternative it is estimated that 35 to 40 percent of the area (approximately 250 to 350 acres) being treated through pre-commercial, commercial or biomass operations will need to have some form of post activity treatment to reduce surface fuel loading. As part of this alternative, post activity treatment would include tractor piling followed by prescribed burning of the piles or hand piling and burning (dependent on steepness of slopes) and/or broadcast burning. Also part of the treatments in this alternative includes prescribed fire use as the initial treatment of an estimated 215 acres. The table below estimates the potential emissions from the average conditions anticipated in the Sugar Pine Adaptive Management Project area. Tons per acre are associated with the existing IFSL fuel models given in the Fire/Fuels Analysis. It is assumed that the areas that are at or above 15 to 20 tons per acre surface fuel loading, prior to any treatment, would require post activity treatments such as piling and burning. Those areas at or less than 10 tons per acre would be considered appropriate for the application of broadcast and/or understory burning for maintenance of surface fuel loadings. Three hundred total acres is used for each fuel model to show the maximum emissions that would be anticipated if all of the acres were at that

fuel loading. It is anticipated that there will be a combination of fuel loadings, both at the higher levels and lower levels, throughout the project area where prescribed fire will be used as a initial treatment or post activity treatment.

Indirect and Cumulative Effects

Although prescribed burning would occur on air district designated burn days, there would be potential for short-term impacts, caused by smoke production, to sensitive areas. From past experience, it is anticipated that limits on acres per day burned, optimal transport wind direction/speed, higher mixing heights and quantity of other prescribed burns being conducted will be considered prior to air district approval to reduce these impacts. This could extend the number of days burning would occur, but would reduce the amount of emissions produced at any one time into smoke sensitive areas. Cumulative effects can be caused by outside influences not associated with the project itself. Because of the rural surroundings, many residences utilize wood burning as their main source of home heating. Hazard reduction burning is also permitted in rural communities in Madera and Mariposa counties. This can lead to cumulative impacts if prescribed burning is conducted on what is considered a marginal dispersal day when added to wood stove smoke and increased numbers of hazard reduction burns within the communities in or surrounding the project area.

Alternative 3

Direct, Indirect and Cumulative Effects

Alternative 3 would not alter the number of acres where ladder and surface fuels are to be reduced through treatments, but would alter the amount of post treatment surface fuels (lower tons/acre) in treatment area T4. It is anticipated this would not produce a significant difference in the estimated emissions produced from initial or post activity prescribed burning. Thus the direct, indirect and cumulative effects would remain the same as those under Alternative 2.

Alternative 4

Direct, Indirect and Cumulative Effects

Alternative 4 would not alter the number of acres where ladder and surface fuels are to be reduced through treatments, but would potentially lower the amount (tons per acre) of post treatment surface fuels. As in Alternative 2, prescribed burning would be utilized to reduce surface fuel loadings as either an initial treatment (understory/broadcast) or as a post activity treatment (pile burning). Dependent on the existing fuel loading, there is still a potential for surface fuel loadings to be as high as that found in an IFSL Fuel Model 12, but not in as many areas as with Alternative 2. It is anticipated that this would lower emissions produced, but not significantly since the same number of acres would need to be treated. Thus the direct, indirect and cumulative effects would remain the same as those under Alternative 2.

Table 34. Total Estimated Tons of Emissions from Initial Treatment and Post Treatment Activities

Emissions										
Fuel Type (choose one)	**Total Acres**	**Tons per acre**	**IFSL Fuel Model**	**Total tons**	**Tons PM10**	**Tons PM2.5**	**Tons Nox**	**Tons SO2**	**Tons VOC**	**Tons CO**
				0	-	-	-	-	-	-
Pile_Slash	300.00	34	12	10200	39.78	37.23	26.52	0.05	32.13	336.60
Pile_Slash	300.00	13	10	3900	15.21	14.24	10.14	0.02	12.29	128.70
Pile_Slash	300.00	10	High 9	3000	11.70	10.95	7.80	0.02	9.45	99.00
Forest	300.00	4	TU1	1050	12.86	11.55	1.84	0.05	7.61	122.33
Forest	215.00	13	10	2795	34.24	30.75	4.89	0.14	20.26	325.62

NOTE: Pile slash would be pile burning emissions and Forest would be understory/broadcast burning. PM10=Particulate matter 10 microns in size; PM2.5=Particulate matter 2.5 microns in size; NOx=Nitrogen Oxides; SO2=Sulfur Dioxides; VOC=Visual Organic Compounds (precursors to smog); CO=Carbon Monoxide.

Transportation

Affected Environment

The transportation system (roads) within the project area provides needed access for public use of the National Forest and access to private lands. Most roads receive low traffic volume, but are considered important by their users for dispersed recreation experiences of many types. Maintenance level 1 and 2 roads are generally open to legal OHV use. These roads also provide needed access for Forest Service administrative uses including fire suppression, fuels reduction, recreation administration, timber harvest, reforestation, and assessment of biological resources.

Reduced funding and road maintenance activities associated with timber harvest have limited opportunities to maintain the road system to proper standards. It is estimated that 80% of the road system within the Sugar Pine Adaptive Management Project area fails to meet current road maintenance standards.

The existing transportation system for the Sugar Pine Adaptive Management Project consists of approximately 39.5 miles of National Forest Transportation System (NFTS) roads. Madera County maintains 1.5 miles of roadway. Mariposa County maintains 0.1 miles of roadway. The transportation system for the analysis area is nearly complete. Small areas may be identified during project planning where minor amounts of new permanent road and temporary road construction are needed.

There are 33.4 miles of NFTS native and aggregate surfaced roads and approximately 6.1 miles of paved roadway. These native surfaced roads are not suited for wet weather use due to erosive soils and lack of armoring.

Most system roads are in poor condition and are experiencing erosion problems due to lack of proper road maintenance, wet weather use, and erosive soils. Many of the local roads have received little to no maintenance over the years and will require heavy maintenance and/or reconstruction to eliminate resource damage and meet acceptable standards established in the Forest Service Handbook 7709.58.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under the No Action alternative, no project activities would take place. Existing road maintenance and reconstruction needed to eliminate resource damage and support equipment access would not take place. There would be no road reconstruction activities on local roads and no new road construction would be needed. The transportation system for the area would continue to receive only minimal, if any maintenance with continued potential for loss of infrastructure investment from erosion, wet weather use and brush encroachment.

Alternative 2 – Proposed Action

Direct, Indirect and Cumulative Effects

The highest priority for Bass Lake Ranger District road management will continue to be safety for the traveling public and employees and improvement and restoration of roads with resource or access needs. Road maintenance and reconstruction will be required for identified roads that do not meet acceptable standards for the proposed service level and transportation system. This work

may include installation of culverts, rolling dips, water bars; and aggregate surfacing where soil erosion is evident; riprap at outlets of culverts, dips and water bars when needed; and minor clearing and widening to a 12-foot road width for equipment access. NFTS roads used for this project will be kept open for public use during sale and post sale activities. Existing landings, skid trails, and temporary roads will be used for timber access, when available.

The Sugar Pine Adaptive Management project is proposing to perform road maintenance and/or road reconstruction activities on all or portions of roads 5S06, 5S17, 5S17X, 5S18, 5S22Y, 5S22YA, 5S79, 5S79A, 6S07, 6S10, 6S47Y, 6S90 and 6S90D. These roads will require a final field review prior to project activities to determine complete road reconstruction and/or road maintenance needs.

The logging systems plan has identified approximately 0.2 miles of new road construction and approximately 0.5 miles of temporary road construction for unit access. After project completion, the new road will remain open to allow access to Yosemite Trails Pack Station facilities; however, all temporary roads will be closed. These roads will require a final field review prior to project activities to determine complete road construction design needs.

There are 26 recorded archeological and historical sites within the Sugar Pine Adaptive Management Project area. A preliminary map review of the location of recorded sites and specified roads shows four road/site conflicts. These road/site conflicts are of minimal concern because of the limited impact of the continued use of the roads, the limited significance of the sites, or the conflicts are easily mitigated.

There is one section of existing forest road 6S90 that was built on previously constructed Madera Sugar Pine Railroad grade. Road 6S90 is scheduled for reconstruction including widening three curves to allow chip van truck access. This will not further affect the historical integrity of the grade.

There are four sites where proposed maintenance or reconstruction of the roads running through them may cause an impact that could be mitigated. The roads that have the most serious road/site conflicts are 5S18, 5S22Y, 5S22YA, and 5S79 which are scheduled for reconstruction.

Planned new road construction, temporary road construction, road reconstruction and road maintenance activities for the Sugar Pine Adaptive Management Project will be reviewed by the District Archeologist to develop mitigation requirements for archeological or road site conflicts prior to work activities.

This relatively low traffic volume road system has received less maintenance in recent years. These roads, mostly maintenance level 2, comprise most of the miles of the road system. Many of them are brushing in and washing out. The results are negative effects on access and environmental resources and loss of the infrastructure investment.

The greatest surface erosion problems occur in highly erodible terrain where existing drainages structures have become non functional due to lack of adequate road maintenance activities and/or wet weather use. Road 6S90 was identified as a native surfaced road located in High Erosion risk soils including the Holland family. Road maintenance and or reconstruction treatments would be considered to reduce the possible adverse effects to water quality and wildlife habitat.

Existing road densities, in general, are acceptable from a wildlife perspective. However, any system roads or unclassified roads not needed should be decommissioned to enhance wildlife habitat and reduce road densities to a more desired level.

Alternative 3

Direct, Indirect and Cumulative Effects

The effects of this alternative would be similar to Alternative 2, since there would be no change in types of activities occurring and utilizing the project area transportation system.

Alternative 4

Direct, Indirect and Cumulative Effects

The effects of this alternative would be similar to Alternative 2, since there would be no change in types of activities occurring and utilizing the project area transportation system.

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).

Maintenance and enhancement of long-term productivity is accomplished through restoration treatments that reduce basal area and number of stems (stand density) in over crowed stands. Stands that exist presently are no longer sustainable or resilient to changing environmental conditions that can and are occurring now and into the future. Drought induced stress, insect or disease attacks and wildfire all can have detrimental effects on the forest of today. Short-term activities described in the action alternatives are intended to lead to the enhancement of long-term productivity by beginning to restore forest conditions that resilient to disturbances.

Actions described in Chapter 1 lead to enhancement of long-term productivity, especially:

- The need to increase the proportion of large trees across a landscape,
- The need to increase the proportion of fire resistant species such as pines,
- The need to reduce wildfire intensity and spread across the landscape, and
- The need to reduce stand density.

Unavoidable Adverse Effects

No unavoidable adverse effects would occur in the project area.

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.

Approximately 0.7 miles of new and temporary road construction is proposed for the Sugar Pine Project. Road construction results in removal of surface soils and subsoil and complete loss of soil productivity within the road prism.

The 0.7 miles of road is approximately 1.2 acres of ground with total loss of soil productivity. The direct effect of this new road construction is irreversible and irretrievable. Erosion on newly constructed roads is usually higher immediately after the road is constructed. There is potential that accelerated erosion could occur off the road prism and reduce soil productivity off site and after the road is constructed. Applicable soil and water conservation Best Management Practices (BMP) will be implemented, including erosion control measures, such as water bars, straw mulching of fills and fertilization of soils to re-vegetate the bare soils. Road reconstruction and road maintenance operate within the road prism and have little effect to the soil resource.

However, there can be a positive effect to the soil resource out site of the road prism from road reconstruction by restoring proper drainage features of the road. Restoration of drainage features will result in less surface erosion and soil loss that leads to loss in soil productivity.

Legal and Regulatory Compliance

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." The proposed action and alternatives must comply with the following regulation.

Principle Environmental Laws

The following laws contain requirements for protection of the environment that apply to the proposed action and alternatives.

Endangered Species Act

The Forest Service is directed to comply with this Act and does so through Biological Assessments and Evaluations that are used to analyze the effects of the proposed alternatives. These assessments and evaluations make determinations on Federally-listed endangered, threatened, candidate and proposed species and their habitat. The analysis was conducted in part to determine whether formal consultation or conference is required with the United States Department of the Interior, Fish and Wildlife Service (USFWS), pursuant to this act.

The Sugar Pine Adaptive Management Project, through the inclusion of design criteria established for all action alternatives for species covered under this Act as well as the completion of Biological Assessments and Evaluations for Botanical, Aquatic and Terrestrial species, is in compliance with this act.

Clean Water Act

The Sugar Pine Adaptive Management Project would comply with this Act by adoption of Best Management Practices and other design criteria established for all action alternatives as detailed in Chapter 2.

Clean Air Act

The Sugar Pine Adaptive Management Project would comply with this Act by implementation of Best Available Control Measures (BACMs) for prescribed burning as required under section 190 of this Act, as amended in 1990.

National Historic Preservation Act (NHPA)

The USDA Forest Service is directed to identify, evaluate, treat, protect, and manage historic properties by several laws. However, the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq.) (NHPA) provides comprehensive direction to Federal agencies about their historic preservation responsibilities.

Section 106 of the NHPA and the ACHP implementing regulations, *Protection of Historic Properties* (36 CFR Part 800), require that Federal agencies take into account the effect of their undertakings on historic properties, and that agencies provide the ACHP with an opportunity to comment on those undertakings. Programmatic agreements (36 CFR 800.14(b)) provide alternative procedures for complying with 36 CFR 800. Pacific Southwest Region 5, USDA

Forest Service has such an agreement: *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 Identification, Evaluation and Treatment of Historic Properties Managed by the National Forest of the Sierra Nevada, California* (Sierran PA). This agreement provides specific standards for conducting cultural resources inventory, evaluation, and management, including Forest Heritage Program requirements, identification standards, standard procedures for protecting cultural resources, reporting and public participation.

Cultural resource design criteria are established for all action alternatives and are based on stipulations within the Sierran PA. All alternatives would be in compliance with historic preservation law, policy and regulation, as this project meets the stipulations of the Sierran PA.

National Forest Management Act

The National Forest Management Act (16 U.S.C. 1604) and the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528–531) gives direction to National Forests to develop National Forest Land and Resource Management Plans that (A) insure consideration of the economic and environmental aspects of various systems of renewable resource management, including the related systems of silviculture and protection of forest resources, to provide for outdoor recreation (including wilderness), range, timber, watershed, wildlife, and fish; (B) provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and for steps to be taken to preserve the diversity of tree species. As set forth by these Acts, the Sierra National Forest Land and Resource Management Plan, as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) in 2004, set specific standards and guidelines which are to be followed during project level planning and implementation.

By the inclusion of design criteria as part of all action alternatives to minimize or eliminate significant environmental effects from proposed management actions as well as the inclusion of standards and guidelines from the Sierra National Forest LRMP and SNFPA ROD 2004 used to design this project, this project would comply with this act.

Soil Productivity

Soil resource management is achieved by maintaining soil productivity using Regional Soil Quality Standard and Guidelines and management direction provided in the LRMP (UDA-FS 1991). The Geology/Soils section, starting on page 39 in Chapter 3, analyzes the existing soil productivity and effects of alternatives on soil productivity.

Management Indicator Species (MIS)

The bioregional scale monitoring strategy for the Sierra NF MIS is found in the Sierra Nevada Forests Management Indicator Species Amendment (SNF MIS Amendment) Record of Decision (ROD) of 2007. Bioregional scale habitat monitoring is identified for all twelve of the terrestrial MIS. In addition, bioregional scale population monitoring, in the form of distribution population monitoring, is identified for all of the terrestrial MIS except for the greater sage-grouse. For aquatic macroinvertebrates, the bioregional scale monitoring identified is Index of Biological Integrity and Habitat. The current bioregional status and trend of populations and/or habitat for each of the MIS is discussed in the Sierra Nevada Forests Bioregional Management Indicator Species (SNF Bioregional MIS) Report (USDA Forest Service 2008).

Other Standards and Guidelines, especially those dealing with Water Quality

Best Management Practices will be applied to all action alternatives and are listed in Appendix B of this document. Design criteria listed in Chapter 2 incorporate additional protection measures to minimize and/or eliminate impacts to water quality.

Executive Orders

The following executive orders provide direction to Federal agencies that apply to the proposed action and alternatives:

Indian Sacred Sites, Executive Order 13007 of May 24, 1996, applies to the proposed action alternatives because of historic and prehistoric uses known in the area. This is specifically addressed in Chapter 3 under Heritage Resources and Tribal Relations. All project alternatives comply with this order.

Protection and Enhancement of the Cultural Environment, Executive Order 11593 of May 13, 1971, directs Federal agencies to inventory cultural resources under their jurisdiction, to nominate to the National Register of Historic Places all Federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and to assure that Federal plans and programs contribute to preservation and enhancement of non-Federally owned properties.

Cultural resource design criteria are established for all action alternatives and are based on stipulations within the Sierran PA. All alternatives would be in compliance with historic preservation law, policy and regulation, as this project meets the stipulations of the Sierran PA.

Invasive Species, Executive Order 13112 of February 3, 1999, applies to the proposed action alternatives. A risk of introducing invasive species does exist. Measures need to be in place to prevent the spread of these species. The proposed action alternatives comply by providing measures to prevent the introduction and spread of invasive species.

Recreational Fisheries, Executive Order 12962 of June 6, 1995, applies to the proposed action alternatives. Action alternatives comply with this order by implementing Best Management Practices and other design criteria and correcting existing resource problems. These design criteria are detailed in Chapter 2 and the list of specific Best Management Practices associated with this project are included in Appendix B of this document.

Migratory Birds, Executive Order 13186 of January 10, 2001. Under the National Forest Management Act (NFMA), the Forest Service is directed to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives (P.L. 94-588, Sec 6 (g) (3) (B))." The January 2000 USDA Forest Service (FS) Landbird Conservation Strategic Plan, followed by Executive Order 13186 in 2001, in addition to the Partners in Flight (PIF) specific habitat Conservation Plans for birds and the January 2004 PIF North American Landbird Conservation Plan all reference goals and objectives for integrating bird conservation into forest management and planning.

> In late 2008, a Memorandum of Understanding (MOU) between the USDA Forest Service and the U.S. Fish and Wildlife Service to Promote the Conservation of Migratory Birds was signed. The intent of the MOU is to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the Fish and Wildlife Service as well as other Federal, State, tribal and local governments. Within the National Forests,

conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for land management activities.

The Sierra National Forest is proposing to manage lands on the Bass Lake Ranger District that are located in the Fresno River and South Fork Merced fifth field watersheds. Proposed management is intended to implement direction contained within the Sierra National Forest Land and Resource Management Plan (LRMP, USFS 1991) as amended by the 2004 SNFPA ROD. Opportunities to promote conservation of migratory birds and their habitats in the project area were considered during development and design of the Sugar Pine Adaptive Management project (MOU Section C: items 1 and 11 and Section D: items 1 and 3).

Within this project area special considerations have been given to maintaining higher levels of biodiversity through actions such as delineating Old Forest Linkages (OFLs) surrounding perennial streams (see EIS and BE/BA for a description of OFLs). Higher levels of biodiversity have also been planned for by marking retention groups of large diameter trees. Two-hundred and eighty (280) such tree groups were identified in the main project area, and an additional 74 were identified in the hydrology study area. These tree groups are composed of a cluster of 3 or more trees, 30-inch dbh or greater, with touching crowns, and will benefit those species which utilize dense groupings of large trees. Another project design measure which will maintain biodiversity is the identification of retention areas around large oaks within treatment units. Two to three large oaks per acre were identified and marked with paint. These oaks will retain a zone of no activity measuring 35 feet, or dripline circumference around the oak (whichever is greater). The delineation of OFLs, retention of large tree groups, and oak no treatment zones will ensure a heterogeneous post treatment landscape resulting in the continued accessibility of both hiding cover and prey availability within these areas of biodiversity.

Likely impacts to habitats and select migratory bird populations resulting from the Sugar Pine Adaptive Management project have been assessed in detail within the project MIS report and impacts to select TES birds and their habitats have been analyzed in the project BA and/or BE.

The project will not adversely impact migratory landbird species or their associated habitats. Potential impacts to migratory species would be minimized through the adherence of LRMP Standards and Guidelines for snags/down woody debris, riparian reserve buffers, limited ground disturbance, and maintenance of canopy closure. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Specific project design criteria include: canopy closure will be maintained at 60 to 70% or greater where available; ground disturbance will be limited to those guidelines with the LRMP as amended; vegetation species diversity and composition will be maintained; no management will occur in designated riparian reserves; and retention of snags and downed logs would be retained at 80 to 100% of the average numbers found within mature and old growth stands within the Forest. Any snag felled for safety reasons will be left on site as downed woody debris. Additional cull logs will be left on site from the logging operation as well. All riparian reserves within the project have been identified and buffers established. In addition, no operations will occur during the wet weather season.

Floodplain Management, Executive Order 11988 of May 24, 1977, does not apply because of exclusions and buffers that are in place through design criteria for the action alternatives and are found in detail in Chapter 2.

Protection of Wetlands, Executive Order 11990 of May 24, 1977, does not apply because of exclusions and buffers that are in place through design criteria for the action alternatives and are found in detail in Chapter 2.

Environmental Justice, Executive Order 12898 of February 11, 1994, applies to the proposed action alternatives. Compliance has been attempted by making this document understandable and accessible.

Use of Off-Road Vehicles, Executive Order 11644, February 8, 1972, does not apply to this proposal. No off road use is being proposed nor existing use changed in this document.

Special Area Designations

The selected alternative will need to comply with laws, regulations and policies that pertain to the following special areas.

Research Natural Areas

No research natural areas are located in the project area. This project would comply with applicable laws, regulations and policies for research natural areas.

Inventoried Roadless Areas

No Inventoried Roadless Areas are located in the project area. This project would comply with applicable laws, regulations and policies for Inventoried Roadless Areas.

Wilderness Areas

No Congressionally-designated wilderness areas are located in the project area. This project would comply with applicable laws, regulations and policies for wilderness areas.

Wild and Scenic Rivers

No Congressionally-designated wild and scenic rivers occur in the project planning area.

Municipal Watersheds (FSM 2540)

No municipal watersheds occur in the project planning area.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with…other environmental review laws and executive orders.”

Species surveys, review of recent literature, and professional judgment have been incorporated into determinations of possible effects on species. Surveys provide information on species presence and habitat on a local scale. An element of uncertainty exists for effects on species with distributions beyond the project or Sierra NF boundaries. The Pacific fisher and Yosemite toad are Forest Service sensitive species that have also been designated by the U.S. Fish and Wildlife Service as candidate species for listing under the Endangered Species Act. A candidate species is determined by the U.S. Fish and Wildlife Service through a 12-month finding as warranted for listing. The listing process is precluded by other priorities. The Sierra NF requested and received technical advice from the U.S. Fish and Wildlife Service to address uncertainty related to these

candidate species. Their advice is integrated extensively throughout the Terrestrial and Aquatic Species sections of Chapter 3 as well as in the design criteria for all action alternatives.

Forest Plan (LRMP) Amendment

The significance of change to a forest plan is different than the significance of environmental impacts of the proposed action, as defined by Council on Environmental Quality regulations found at 40 CFR 1500 to 1508.

The following discussion is strictly about the significance of a change to a forest plan. The 1982 Planning Rule at 36 CFR 219.10 (f) states, "Based on an analysis of the objectives, guidelines, and other contents of the forest plan, the Forest Supervisor shall determine whether a proposed amendment would result in a significant change in the plan." According to FSM 1920, the following changes are used to determine whether the proposed amendment is significant or not significant.

Multiple-use Goals and Objectives

None of the alternatives change multiple-use goals and objectives for long-term land and resource management found in the original LRMP (Forest Plan), as amended by the SNFPA ROD 2004.

Standards and Guidelines

Alternative 2 (Proposed Action) for this specific project would change SNFPA ROD 2004 Standard and Guideline #86 to allow stand density treatments as well as treatment of ladder and surface fuels for the one time of this decision. This would apply to only Alternative 2 (Proposed Action) in treatment areas proposed.

Changes that have an important effect on an entire forest plan or affect land and resources throughout a large portion of a planning area are considered for forest plan amendments. This amendment applies only to the estimated 5,416 acres of this decision.

According to FSH 1909.12, the following factors are used to determine whether the proposed amendment is significant or not significant.

Timing

This amendment would only be effective if Alternative 2 (Proposed Action) were selected by the deciding official. If Alternative 2 was selected in the record of decision (ROD), the amendment would only be effective through the life of the decision, expected to be about 10 years.

Location and Size

The amendment applies only to the 5,416 acres within the Sugar Pine Adaptive Management Project boundary and more specifically to the treatment areas where there are currently known Pacific Fisher den sites.

Goals, Objectives and Outputs

This amendment would not alter long-term relationships between levels of goods and services projected by the forest plan, as amended by the SNFPA ROD 2004. This amendment would not involve a demand for new goods and services not discussed in or contemplated by the forest plan as amended. The amendment would not alter the output because it does not adjust the capable, available and suitable land base.

Management Prescriptions

This amendment does not change any management prescriptions in the LRMP (Forest Plan), as amended.

Conclusion

This amendment is not significant because it does not change any multiple-use goals or objectives, any management area boundaries, or management prescriptions. This amendment only affects a very small portion of the forest plan.

Chapter 4. Consultation and Coordination

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental document:

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Federal, State, and Local Agencies

Although no formal or informal consultation was required for this project, personnel communications with Federal, State and Local Agencies including, but not limited to; U.S. Fish and Wildlife Service, California Department Fish and Game, The Resources Agency (CalFire), University of California Academics and other Memorandum of Understanding Signatory Agencies occurred throughout the planning stages of this project as part of the Sierra Nevada Adaptive Management Project.

Tribes

North Fork Mono Rancheria; Picayune Rancheria of the Chukchansi Indians; Mariposa Indian Council; Mono Nation; California Indian Basketweavers Association.

Others

Sierra Nevada Adaptive Management Project-Integration Team; Science Team-Sierra Nevada Adaptive Management Project.

Distribution of the Environmental Impact Statement

This draft environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies have been sent to the following Federal agencies, Federally-recognized tribes, State and local governments, and organizations:

Advisory Panel on Historic Preservation, USDA-Animal and Plant Health Inspection Service, USDA-Natural Resources Conservation Service, USDA-National Agricultural Library, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, South Pacific Division-US Army Engineer, Region 9-Environmental Protection Agency, US Department of the Interior, US Coast Guard, Western Pacific Region-Federal Aviation Administration, US Department of Energy, Federal Highway Administration, U.S. Fish and Wildlife Service, California Department of Fish and Game, North Fork Mono Rancheria, Picayune Rancheria of the Chukchansi Indians, Mariposa Indian Council, Mono Nation, Madera and Mariposa County Board of Supervisors, San Joaquin Valley Air Pollution Control District, local Chapter of Society of American Foresters, Eastern Madera Fire Safe Council, Mariposa Fire Safe Council, Coarsegold Resource Conservation District, Sierra Forest Legacy, National Chapter and Tehipite Chapter-Sierra Club, John Muir Project, California Indian Basketweavers Association, Sugar Pine Railroad, Yosemite Trails Pack Station and Tenaya Lodge.

Glossary

Adaptive Management: A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions provides information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

Air Shed: A geographical area that shares the same air mass due to topography, meteorology, and climate.

Analysis Area: A collection of land area, not necessarily contiguous, sufficiently similar in character that they can be treated as if they were identical.

Aspect: A position facing a particular direction, usually expressed as a compass direction in degrees or cardinal directions.

Bark Beetle: A member of the family Scolytidae (*Coleoptera*). Adults and larvae tunnel in the cambial region (either in the bark only or in the bark and xylem) of living, dying and recently dead or felled trees and utilize these areas for food and shelter.

Basal Area: The area of the cross section of a tree trunk near its base, usually 4½ feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

Baseline: Starting point for analysis of environmental consequences. A baseline may be conditions at a point in time or collected over a specified period of years.

Best Management Practices (BMPs): Practices determined to be the most effective and practicable means of controlling pollutants at levels compatible with environmental quality goals. BMPs were conceptualized in the 1972 FUS Federal Water Pollution Control Act. BMPs as defined in the USDA Forest Service Soil and Water Conservation Handbook.

Biomass thin: Used in this document to describe the cutting of vegetation (conifers) that may or may not have a market value, but are removed from site after cutting. For this document this is considered a conifer approximately 4-10 inches in diameter.

Breast Height (as referred to as dbh): A standard height from ground level, generally 4.5 feet for recording diameter, circumference or basal area of a tree.

Broadcast Burn: A type of prescribed fire allowed to burn over a designated area within defined boundaries to achieve land management objectives.

Buffer: A land area designated to block or absorb unwanted impacts to the area inside the buffer.

Bulk Density: The weight per unit volume of a measured material. Bulk density of plants is measured at a specified moisture tension.

California Wildlife Habitat Relationship System (CWHR): A wildlife information and predictive system for mammals, reptiles, and amphibians. This system is considered a state-of-the-art information system for California's wildlife. The system provides the most widely used habitat relationship models for California's terrestrial vertebrate species. CWHR is operated and maintained by the California Department of Fish and Game, in cooperation with the California Interagency Wildlife Task Group (CIWTG).

Canopy: Foliar cover in the forest stand consisting of one or several layers.

Chaparral: Dense growth of mostly small-leaved evergreen shrubs. Found in the foothills of California.

Classified Roads: Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access including State roads, County roads, privately owned roads, National Forest Transportation System roads, and roads authorized by the Forest Service that are intended for long-term use.

Clump: An isolated, generally dense, group of trees.

Codominant: Tree species in a forest that are about equally numerous and exert the greatest influence.

Cohort: A group of trees developing after a single disturbance, commonly consisting of trees of similar age. A considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance can be included.

Commercial thin: Used in this document to describe the cutting and removal from site of vegetation (conifers) that typically has a market value. For this document this is considered a conifer over approximately 10 inches in diameter.

Corridor: Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows where wildlife feed.

Cover: Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to rest, feed, and escape from predators.

Crown: The upper part of a tree that carries the main branch system and foliage.

Crown Closure: The point at which the vertical projections of a crown's perimeter within a canopy touches.

Crown Density: The amount and compactness of foliage for trees or shrubs.

Cumulative Effects: Combined effects resulting from sequential actions on a given area.

Den Tree: A tree that contains a weather tight cavity for wildlife.

Defensible fuels profile(s), Defensible Fuel Profile Zone(s), DFPZ(s): A strategically located strip(s) of land where the vegetation has been modified to a less dense fuel type. These are typically located along ridgetops and roads and are areas where fire fighters would make a stand to contain a fire. The width is based on potential fire behavior based on available fuels, weather and wind, and topography. They are not designed to stop an oncoming wildfire by themselves, but rather to provide a safe location to facilitate fire suppression efforts and provide an anchor point for prescribed burning projects. The DFPZ strategy initially treats a lower proportion of the landscape; treatments are located to protect specific values and are typically placed in wildland urban intermix areas. After a network of DFPZs is established, area fuel treatments (SPLATs) can be placed to enhance DFPZ effectiveness and increase the likelihood tat the overall landscape strategy will reduce wildfire intensity and size.

Diameter Class: Intervals into which a range of diameters of tree stems or logs may be divided for classification or use.

Disturbance: A force that results in changes in the structure and composition through natural events such as wind, fire, flood, avalanche, or mortality caused by insect or disease outbreaks or human events (e.g. timber harvest).

Duff: Organic material covering the forest floor (includes fresh litter from plants and older, well developed humus).

Ecosystem: An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within the ecosystems.

Elevation: Vertical distance of measure displayed in feet above sea level.

Endangered Species: A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Endemic Species: Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

Environmental Effects: Includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health whether direct (which are caused by action and occur at the same time and place), indirect (which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable), or cumulative (results from the incremental impact of the action when added to other past, present or reasonably foreseeable future actions).

Environmental Impact Statement (EIS): A document prepared by a Federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. Federal statute (Section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. An impact statement includes: (1) the environmental impact of the proposed action, (2) any adverse impacts which cannot be avoided by the action, (3) alternatives courses of actions, (4) relationships between local short-term use of the human environment and the maintenance and enhancement of long-term productivity, and (5) a description of the irreversible and irretrievable commitment of resources which would occur if the action were accomplished.

Ephemeral Stream: A stream or portion of a stream that flows only in direct response to precipitation, receiving little or no water from springs and no long continued supply from snow or other sources and whose channel is at all times above the water table.

Erosion: The wearing away of land surface by rain, running water, wind, ice, gravity, or other natural agents including gravitational creep and tillage.

Feasibility: Capability and suitability for specific use.

Fire Behavior: The over-arching means by which to describe how an ignited fire reacts to the influences of fuels, topography and weather when combined together. Typical terms used when describing fire behavior include rate of spread (how fast a fire travels over a given distance in a given period of time); flame height (as measured in feet from ground through middle of flame); intensity (BTUs given off from flaming front); fire type (surface vs. crown) to name a few. Computer based models are used to predict fire behavior for given environmental and fuel conditions.

Flow: The movement of a stream of water or other mobile substances from place to place. The movement of water and the moving water itself. The volume of water passing a given point per unit of time.

Forage: All browse and non-woody plants that are eaten by wildlife.

Forb: A grouping or category of herbaceous plants which are not included in grass, shrub or tree groupings, generally smaller flowering plants. Forbs contain little or no woody material.

Forest: An ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands of varying in characteristics such as species composition, structure, age class, and associated processes. Commonly includes meadows, streams, fish and wildlife.

Forest Health: The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function and vigor, presence of unusual levels of insects or disease, and resilience to disturbance. Individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that make up the forest, and the appearance of the forest at a point which influences the perception and interpretation of forest health.

Forest Plan: Also referred to as a Land and Resource Management Plan (LRMP). A signed document that is the source of management direction for an individual National Forest that specifies activity and output levels for a period of 10-15 years. Management direction in the Forest Plan is based on issues identified at the time of Plan development.

Forestry: The profession embracing the science, art and practice of creating, managing, using and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs and values.

Forest Type: A category of forest usually defined by its vegetation, particularly its dominant vegetation as based on percentage cover of trees.

Fragmentation: The process by which a landscape is broken into small islands of forest within a mosaic of other forms of land use or ownership.

Frequency: 1. biometrics: the number of occurrences of a given type of event of the number of members of a population falling into a specified class; 2. ecology: the number of individuals in a community.

Fuelbreak: A wide strip or block of land on which the native vegetation has been modified so that fires burning into it can be more readily suppressed. Usually strategically build in conjunction with a roadway (for access) and along ridgelines. Terms like shaded fuelbreak is used to differentiate the amount or type of vegetation that is removed to create the fuelbreak.

Geographic Information System (GIS): A system of computer maps with corresponding site-specific information that can be electronically combined to provide reports and maps.

Habitat: The place where an animal, plant or population normally lives and develops.

Habitat capability: The ability of a land area or plant community to support a given species of wildlife.

Headcuts: Land erosion at the head of a stream, creek, or river.

Headwater: The source of a stream. The upper tributaries of a drainage basin.

Herb: A non-woody, vascular plant.

Herbaceous: A class of vegetation dominated by no-woody plants known as herbs.

Horizon (soil): A layer of soil approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical and biological properties or characteristics such as color, structure, texture, consistency, kinds and number of organisms present, degree of acidity or alkalinity.

Indigenous: Native to a specified area or region.

Indirect Effects: Effects that are caused by an action and occur at a later time, or at another location, yet are reasonably foreseeable in the future.

Insect: A member of the class Insecta characterized by a body segmented into three distinct regions (head, thorax, abdomen), by a head with one pair of antennae, by a thorax with three segments each with a pair of legs, and usually one or two pairs of thoracic wings.

Interdisciplinary Team (IDT): A group of specialists assembled to solve a problem or perform a task.

Invasive Plants: Plant species that are introduced into an area in which they did not evolve and in which they usually have few or no natural enemies to limit their reproduction and spread. These species can cause environmental harm by significantly changing ecosystem composition, structure, or processes and can cause economic harm or harm to human health.

Ladder fuels or fuel ladders: Arrangement of vegetation (trees, brush, etc.) that provides vertical continuity from the forest floor to the crowns of overstory trees. Example would be similar to steps on a ladder.

Land and Resource Management Plan (LRMP): See Forest Plan

Landscape: A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate and human impacts. Landscapes are often used for coarse grain analysis.

Maintenance: The work of keeping something in proper condition or standard.

Masticate or Mastication: Means by which vegetation is mechanically "mowed" into small pieces and changed from a vertical to horizontal arrangement.

Management Indicator Species (MIS): Animals or plants identified in Forest Land and Resource Management Plans (LRMPs or forest plans) developed under the 1982 Planning Rule, that are selected because their population changes are thought to indicate the effects of Forest Service management activities.

Mechanical Methods: Utilization of machinery such as bulldozers and skidders for tractor logging; helicopter logging, skyline cable logging, mechanical harvesters and shredders/masticators.

Merchantable: Having the size, quality and condition suitable for marketing under a given economic condition.

Mitigation: Actions taken to avoid, minimize or rectify the impact of a land management activity.

Model: A representation of reality used to describe, analyze or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization or a highly abstract set of mathematical equations. A model has limits to its effectiveness and is used as one of several tools to analyze a problem.

Mortality: Trees dying from natural causes, usually by size class in relation to sequential inventories or subsequent to incidents such as storms, wildfire or insect and disease epidemics.

Mosaic: A pattern of vegetation in which two or more kinds of communities are interspersed in patches, such as clumps of shrubs with grassland between.

National Environmental Policy Act (NEPA): Congress passed in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA

is its emphasis on public disclosure of possible environmental effects of any major action on public lands. Section 102 of NEPA requires a statement of possible environmental effects to be released to the public and other agencies for review and comment.

Native Species: Indigenous species normally found as part of a particular ecosystem.

Natural Fuel: Term used to describe vegetation, live or dead, in a given area that is not associated with being created by management activities. It is usually described in terms of natural fuel accumulations or build-up from naturally falling leaves, branches and/or logs from fallen snags.

Notice of Intent (NOI): A notice printed in the *Federal Register* announcing that an Environmental Impact Statement will be prepared. The NOI must describe the proposed action and possible alternatives, describe the proposed agency scoping process and provide a contact person for further information.

Noxious Weeds (Plants): An undesirable, non-native plant that is difficult to control and is on either the California Department of Food and Agriculture Noxious Weed list or the California Invasive Plant Council Inventory of invasive plants in California.

Old-growth (forest): Old forests often containing several canopy layers, variety in tree sizes and species; and standing and dead woody materials.

Patch: An area of homogeneous vegetation, in structure and composition.

Pathogen: A parasitic organism directly capable of causing disease.

Perennial Stream: A stream that has running water on a year-round basis under normal climatic conditions.

Pre-commercial thin: Used in this document to describe the cutting of vegetation (conifers) that does not typically have a market value and not removed from site after cutting. For this document this is considered a conifer approximately 4-10 inches in diameter.

Prescribed burning (fire): With a given range environmental condition (air temperature, fuel moisture, windspeed and direction, etc.) and approved plan, a fire that is management ignited to meet specific resource management objectives. This can include dozer/hand pile; understory and broadcast burning.

Rate of Spread: The relative speed with which a fire increases in size usually expressed in chains (66 feet) per hour.

Record of Decision (ROD): An official document in which a deciding official states the chosen activity (alternative) that will be implemented from a prepared EIS.

Reforestation: The restocking of an area with forest trees, by either natural or artificial means, such as planting.

Regeneration: The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.

Residual: A tree or snag remaining after an intermediate of partial cutting of a stand.

Resilience: The ability of an ecosystem to maintain diversity, integrity and ecological processes following a disturbance.

Resistance: The ability of a community to avoid alteration of its present state by a disturbance. The ability of plants to avoid, suppress, prevent, overcome, or tolerate insect or pathogen attack.

Responsible Official: The Federal employee who has the delegated authority to make and implement a decision on a proposed action.

Riparian Area: The area along a watercourse or around a lake or pond.

Riparian Ecosystem: The ecosystems around or next to water areas that support unique vegetation and animal communities as a result of the influence of water.

Riparian Conservation Areas (RCAs): These are land allocations that are managed to maintain or restore the structure and function of aquatic, riparian and meadow ecosystems. The intent of management direction for RCAs is to (1) preserve, enhance, and restore habitat for riparian-and aquatic-dependent species; (2) ensure that water quality is maintained or restored; (3) enhance habitat conservation for species associated with the transition zone between upslope and riparian areas; and (4) provide greater connectivity within the watershed.

Risk: The relative probability of any of several alternative outcomes as determined or estimated by a decision maker when the outcome of an event or series of events is not known.

Road Maintenance: The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objectives.

Road Reconstruction: Activities that result in road realignment or road improvement.

Sample: A part of a population selected and examined as a representative of the whole.

Sediment (sedimentation): Solid materials, both mineral and organic, in suspension or transported by water, gravity, ice or air; may be moved and deposited away from their original position and eventually will settle to the bottom.

Sensitive Species: Plant or animal species which are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the Regional level and is not part of the designation of threatened or Endangered Species made by the U.S. Fish and Wildlife Service.

Shade tolerant: When used to describe a conifer, the trees prefers to grow in the shade.

Silvicultural System: The cultivation of forest; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.

Silviculture: The art and science that promotes the growth of single trees and the forest as a biological unit.

Simulation: An operations research technique that represents physical, natural, social and economic systems by models in order to study the factors affecting the system and to aid decision making.

Site: The area in which a plant or a stand grows, considered in terms of its environment, particularly as this determines the type and quality of the vegetation the area can carry.

Site Preparation: Removing unwanted vegetation, slash, roots and stones from a site before reforestation. Naturally occurring wildfire, as well as prescribed fire can prepare a site for natural regeneration.

Skid Road (skid trail): A road access cut through the woods for skidding of logs.

Skidder: A self-propelled machine (cable, clam-bunk or grapple) used for dragging trees or logs.

Skidding: Hauling logs by sliding, not on wheels, from stump to a collection point.

Slash: Residue left on the ground after timber cutting or left after a storm, fire or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.

Snag: A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

Soil Compaction: Reduction of soil volume. The weight of heavy equipment, for example, on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

Species: The main category of taxonomic classification into which genera are subdivided, comprising a group of similar interbreeding, individuals sharing a common morphology, physiology and reproductive process.

Stand: A group of trees that occupies a specific area and is similar in species, age, and condition.

Stand density: A quantitative measure of stocking expressed either absolutely in terms of number of trees, basal area, or volume per unit area or relative to some standard condition. A measure of the degree of crowding of trees within stocked areas commonly expressed by various growing space ratios.

Stand Structure: The physical and temporal distribution of plants in a stand. Silviculture the horizontal and vertical distribution of components of a forest stand including the height, diameter, crown layers and stems of trees, shrubs, herbaceous understory, snags and down woody material.

Standards and Guidelines: Direction outlined in the Forest Land and Resource Management Plan (LRMP) for specific aspects of project planning and analysis.

Stocking: An indication of growing-space occupancy relative to a pre-established standard.

Strategically Placed Landscape Area Treatments: Wildland fire modification strategy (created from research conducted by Dr. Mark Finney (1999)) by which a fire is forced to go around areas where fuels have been reduced or otherwise modified. The treated areas function as "speedbumps" on the landscape to slow the spread and reduce the intensity of oncoming fires and thereby reduce damage to both treated and untreated areas.

Streamside Management Zones (SMZs): Management Zones established to protect and maintain water quality, site productivity, channel stability, wildlife habitat, and riparian vegetation.

Structure: Sizes, shapes and/or ages of the plants and animals in an area.

Surface Fuels: Vegetation, either dead or live, that is on the surface, which includes dead branches, blowdown timber, leaves, and low vegetation, as contrasted with *crown fuels*.

Thinning from below: A silvicultural technique by which cutting is done in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees. From below describes the incremental cutting of trees based on its position in the stand. First starting with suppressed, then intermediates, then co-dominates to reach a desired or prescribed basal area for the stand.

Threatened Species: Plant or animal species likely to become endangered throughout all or part of their range in the foreseeable future. Designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Understory: The trees and woody shrubs growing beneath the overstory in a stand of trees.

Viability: The ability of a population of a plant or animal species to persist for some specified time into the future. Viable populations are populations that are regarded as having the estimated numbers and distribution of reproductive individuals to ensure that its continued existence is well distributed in a given area.

Watershed: The entire region drained by a waterway (or into a lake or reservoir). More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at the point.

Weed: A valueless, troublesome or noxious plant often exotic, growing wild especially on growing profusely. A plant growing where it is not wanted.

Wildfire: Any wildland fire that is not a prescribed fire.

Wildland: Land other than that dedicated for other uses such as agriculture, urban, mining or parks.

Wildland Urban Intermix (WUI): The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Wildfire Intensity: Describes the buildup of heat within a fire, both in amount and in rate of transmission-a function of heat release. Usually described as low, moderate or high intensity fires.

Wildlife: All non-domesticated animal life.

Woodland: A forested area; a plant community in which, in contrast to a typical forest, the trees are often small, characteristically short-boled relative to their crown depth and forming an open canopy with the intervening area being occupied by lower vegetation, commonly grass.

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Appendices

Appendix A – Map Package for Sugar Pine Adaptive Management Project

Appendix B – Best Management Practices Associated with Sugar Pine Adaptive Management Project

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 1-1 Timber Sale Planning Process: To incorporate water quality and hydrologic considerations into the timber sale planning process.	Implemented through the Riparian Conservation Objectives/Forest Plan Consistency report, specification of operational BMPs, Environmental Analysis including interdisciplinary team office and field discussions, and incorporation of water quality protection measures in the Timber Sale Contract for the KRP EIS.
BMP 1-4 Use of Sale Area Maps (SAM) and/or Project Maps for Designating Water Quality Protection Needs: To ensure recognition and protection of areas related to water quality protection delineated on a SAM or project map.	The sale administrator and purchaser will review these areas on the ground prior to commencement of ground disturbing activities. Examples of water quality protection features that will be designated on the project map include: a. Location of streamcourses and riparian zones to be protected, including the width of the protection zone for each area. b. Wetlands (meadows, lakes, springs, etc.) and other sensitive areas (such as shallow soils) to be protected. c. Boundaries of harvest units, specified roads and roads where hauling activities are prohibited or restricted, areas of different skidding and/or yarding methods, including post-harvest fuels treatments, and water sources available for purchaser use.
BMP 1-5 Limiting the Operating Period of Timber Sale Activities: To ensure that the purchasers conduct their operations, including erosion control work, road maintenance, and so forth, in a timely manner, within the time frame specified in the Timber Sale Contract.	The purchaser contract operation period will be limited to contract-specified periods when adverse environmental effects are not likely. The Sale Administrator will close down operations due to rainy periods, high water, or other adverse operating conditions in order to protect resources.
BMP 1-8 Streamside Management Zone Designation: To designate a zone along riparian areas, streams and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values.	Streamside management zones (SMZs) have been supplemented with RMAs and RCAs (USDA-FS 2004b) as described in Appendix E and the Aquatics design measures. Within SMZs, the constraints defined in Sierra Supplement No. 1 (USDA Forest Service, 1989) apply. This includes no self-propelled ground based equipment, a minimum groundcover of 50%, and shade canopy may not be modified in a way that affects stream temperature. Modifications to these guidelines are possible where site-specific needs exist if the action is reviewed by a hydrologist or fisheries biologist.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 1-9 Determining Tractor Loggable Ground: To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.	Limit ground skidding and machine piling with tractors to slopes less than 35%. Endlining can be used to remove logs from steeper slopes. Ground disturbance on areas of shallow soils, notably soils adjacent and abutting to rock outcrops, will be avoided.
BMP 1-10 Tractor Skidding Design: By designing skidding patterns to best fit the terrain, the volume, velocity, concentration, and direction of runoff water can be controlled in a manner that will minimize erosion and sedimentation.	The sale administrator and purchaser will designate all skid trails prior to ground disturbing activities. If uncertainty arises regarding potential resource impacts of skid trail location, consult with an earth science specialist (i.e., hydrologist, aquatic biologist, or soil scientist).
BMP 1-11 Suspended Log Yarding in Timber harvesting: To protect the soil mantle from excessive disturbance; to maintain the integrity of the SMZ or other sensitive watershed area; to control erosion on cable corridors.	Helicopter yarding has been specified on steep slopes in this project.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 1-12 Log Landing Location: To locate new landings in such a way as to avoid watershed impacts and associated water quality degradation	The following criteria are to be used by the Sale Administrator when evaluating landings: a. The cleared or excavated size of landings will not exceed that needed for safe and efficient skidding and loading operations. Trees considered dangerous will be removed around landings to meet the safety requirements of OSHA. b. Selected landing locations will involve the least amount of excavation and fill possible. Landings must be located outside of SMZs. c. Locate landings near ridges away from headwater swales in areas that will allow skidding without crossing stream channels, violating SMZs, or causing direct deposit of soil and debris to a stream. d. Locate landings where the least number of skid roads will be required, and sidecast can be stabilized without entering drainages or affecting other sensitive areas. Keep the number of skid trails entering a landing to a minimum. e. Position landings such that the skid road approach will be nearly level as feasible, to promote safety and to protect soil from erosion. f. Avoid excessive fills associated with landings constructed on old landslide benches. g. Construct stable landing fills or improve existing landings by using appropriate compaction and drainage specifications. In some cases, using an existing landing located within an RCA or CAR is preferable to constructing a new landing outside of it. These situations will be reviewed on a site-by-site basis by an earth science specialist (aquatics, hydrology, geology, or soils).
BMP 1-13 Erosion Prevention and Control Measures during Timber Sale Operations: To ensure that the purchasers' operations will be conducted reasonably to minimize soil erosion.	Timber purchaser responsibilities for erosion control will be set forth in the Timber Sale Contract. Equipment will not be operated when ground conditions are such that excessive damage will result. The kinds and intensity of control work required of the purchaser will be adjusted by the sale administrator to ground and weather conditions with emphasis on controlling overland runoff, erosion, and sedimentation. Erosion control work required by the contract will be kept current. At certain times of the year this means daily, if precipitation is likely or weekly when precipitation is predicted for the weekend. Erosion prevention measures must be applied no later than October 1 and immediately upon completion of activity begun after November 1. If the purchaser fails to perform seasonal erosion control work prior to any seasonal period of precipitation or runoff, the Forest Service may temporarily assume responsibility, complete the work, and use any unencumbered deposits as payment for the work.

<table>
<tr><th>BMP Name, Objective, and Direction</th><th>Application to the Sugar Pine Project</th></tr>
<tr><td>BMP 1-16 Log Landing Erosion Protection and Control: To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures.</td><td>Landings will be properly cross-ditched, ripped (if soils are compacted), re-contoured (as necessary), and mulched after use and before the winter precipitation period, whichever comes first. Excess material not needed for erosion control can be piled and burned. Upon completion of the project, consult with the hydrologist or soil scientist to determine the need for additional soil protection measures.</td></tr>
<tr><td>BMP 1-17 Erosion Control of Skid Trails: To protect water quality by minimizing erosion and sedimentation derived from skid trails.</td><td>Erosion control measures will be installed on all skid trails, tractor roads, and temporary roads. Erosion control measures include, but are not limited to, cross ditches (water bars), organic mulch, and ripping.

Cross ditches will be spaced according to the guidelines below, maintained in a functioning condition, and placed in locations where drainage would naturally occur (i.e., swales). The level of maintenance will be contingent upon existing or predicted weather patterns as determined by the Sale Administer (see BMP 1-13).
<table>
<tr><th colspan="2">Minimum Cross Drain Spacing</th></tr>
<tr><td>% Slope</td><td>Maximum Spacing</td></tr>
<tr><td>0 - 15</td><td>125 feet</td></tr>
<tr><td>15 - 35</td><td>45 feet</td></tr>
</table></td></tr>
<tr><td>BMP 1-18 Meadow Protection during Timber Harvesting: To avoid damage to the ground cover, soil, and hydrologic function of meadows.</td><td>Mechanical equipment is not permitted in meadows unless specifically authorized by an aquatic biologist and hydrologist.</td></tr>
</table>

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 1-19 Streamcourse and Aquatic Protection: The objectives of this BMP are: 1) To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values. 2) To provide unobstructed passage of stormflows. 3) To control sediment and other pollutants entering streamcourses. 4) To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.	a. The location and method of crossings on Class IV and V streams must be agreed to by the sale administrator (SA) prior to construction. b. Stream crossings on Class I – III streams must be approved by the hydrologist and aquatic biologist. c. Damage to stream banks and channels will be repaired to the extent practicable. d. All sale-generated debris will be removed from streamcourses, unless otherwise agreed to by the SA, and in an agreed upon manner that will cause the least disturbance. e. Felled trees will not be pulled across perennial or intermittent stream channels without prior approval by the hydrologist or aquatic biologist. f. Methods for protecting water quality while utilizing tractor skid trail design in stream course areas where harvest is approved include: (1) end lining, (2) falling to the lead, and (3) utilizing specialized equipment with low ground pressure such as feller buncher harvester. g. Water bars or other erosion control structures will be located so as to disperse concentrated flows and filter out suspended sediments prior to entry into streamcourse. h. Material from temporary road construction and skid trail streamcourse crossings will be removed and streambanks restored to the extent practicable. i. Special slash treatment site preparation activities will be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment. j. Project-related bare soil areas (e.g. skid trails, landings, temporary roads, etc.) will be covered with existing native vegetation mulch, organic debris, or certified weed free straw to at least 50%, well distributed cover, and cross-ditched per BMP 1-17 requirements.
BMP 1-20 Erosion Control Structure Maintenance: To ensure that constructed erosion control structures are stabilized and working	During the period of the timber sale contract, the purchaser will provide maintenance of soil erosion control structures contracted by the purchaser until they become stabilized, but not more than one year after their construction. If the purchaser fails to do seasonal maintenance work, the Forest Service may assume the responsibility and charge the purchaser accordingly. The Forest Service sale administrator is responsible for ensuring erosion control maintenance work is completed.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 1-21 Acceptance of Timber Sale Erosion Control Measures before Sale Closure: To ensure the adequacy of required erosion control work on timber sales.	The sale administrator must inspect erosion control measures to ensure their adequacy prior to accepting closure on the unit and/or sale. The effectiveness of erosion control measures will be evaluated using BMPEP protocols (see Monitoring Plan) after the sale area has been through one or more wet seasons. This evaluation is to ensure that erosion control treatments are in good repair and functioning as designed before releasing the purchaser from contract responsibility. The purchaser is responsible for repairing erosion control treatments that fail to meet criteria in the Timber Sale Contract, as determined by the Sale Administer, for up to one year past closure of the sale.
BMP 1-22 Slash Treatment in Sensitive Areas: To maintain or improve water quality by protecting sensitive areas from degradation which would likely result from using mechanized equipment for slash disposal.	All burn piles made with mechanical equipment must be located outside of the SMZ. Hand piles will be kept at least 20 feet away from all streams, meadows, springs, seeps, and other sensitive aquatic areas. In Alternative 3, special mechanized fuels treatment has been specified in sub-watersheds with cumulative watershed effects concerns in order to minimize ground disturbance.
BMP 2-1 General guidelines for the Location and Design of Roads: To locate and design roads with minimal resource damage.	The following considerations are incorporated into the planning process of road location and design. These measures are preventative, apply to all transportation activities, and indirectly protect water quality: a. Transportation facilities will be developed and operated to best meet the resource management objectives with the least adverse effect on environmental values. b. The location, design, and construction of roads will include the use of the IDT. c. Sensitive areas such as wetlands, inner gorges, and unstable ground will be avoided to the extent practicable. d. Stream crossings will be designed to provide the most cost efficient drainage facility consistent with resource protection, facility needs, and legal obligations.
BMP 2-2 Erosion Control Plan: To mitigate and control erosion through effective planning prior to initiation of construction.	Any new construction would be subject to erosion control measures as per an IDT approved plan that may include but not be limited to waterbar installation, sediment fencing, culvert installation and armoring, placement of straw waddles, approved straw cover and/or slash and any other method necessary to mitigate erosion and sediment routing in the project subwatershed(s).

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 2-3 Timing of Construction Activities: To minimize erosion by conducting operations during minimal runoff periods and when soils are dry and less prone to compaction.	Ground-disturbing activities will occur when soils are dry. In some cases soils may never dry sufficiently. Ground-disturbing work that occurs off of existing roads will occur during the dry season and will reduce ground disturbance as much as possible.
BMP 2-5 Road Slope Stabilization Construction Practices: To reduce sedimentation by minimizing erosion from road slopes and slope failure along roads.	An adequate soils and geologic investigation will be conducted when finalizing new road construction designs for: correct cut and fill steepness based on the angle of repose for the type of material; methods to handle surface runoff; and necessary compaction standards and surfacing needs.
BMP 2-7 Control of Road Drainage: To minimize the erosive effects of water concentrated on roads, to disperse runoff from road surfaces, to lessen sediment yield from roaded areas, and to minimize erosion of the road prism.	Newly constructed or reconstructed roads will be designed to reduce hydrologic connectivity and soil erosion wherever feasible. The sale administrator or other Forest Service representative will ensure that roads are adequately maintained during project implementation to ensure that road drainage features function as designed.
BMP 2-8 Constraints Related to Pioneer Road Construction: To minimize sediment production and mass wasting from pioneer road construction.	a. Roads will be constructed within the planned roadway limits unless otherwise specified or approved by the ER or COR. b. Pioneer roads will be located to prevent undercutting of the designated final cut slope, avoid deposition of materials outside the designated roadway limits, and accommodate drainage with temporary culverts or log crossings. c. Erosion control work will be completed prior to the rainy season and in accordance with the contract. d. Crossing sites on live streams will be dewatered during construction with diversion devices (see BMP 2-15).
BMP 2-9 Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects: To minimize erosion and sedimentation from disturbed ground on incomplete projects.	Erosion control must be completed before the rainy season (usually October in the KRP project area). Preventative measures for timely erosion control include: a. Removal of temporary culverts, culvert plugs, diversion dams, or elevated stream crossings. b. Installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, debris racks, or other facilities needed to control erosion. c. Removal of debris, obstructions, and spoil material from channels and floodplains. d. Planting vegetation, mulching, and/or covering exposed surfaces with jute mates or other protective material.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 2-10 Construction of Stable Embankments: To construct embankments with materials and methods which minimize the possibility of failure and subsequent water quality degradation.	Roadways will be designed and constructed as stable and durable earthwork structures with adequate strength to support the treadway, shoulders, subgrade and road traffic loads.
BMP 2-11 Control of Sidecast Material During Construction and Maintenance: To minimize sediment production originating from sidecast material during road construction or maintenance.	Sidecasting is not permitted within SMZs. Waste areas must be located where excess material can be deposited and stabilized.
BMP 2-12 Servicing and refueling equipment: To prevent pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels.	Storage of hazardous materials (including fuels) and servicing and refueling of equipment will be conducted at pre-designated locations outside of RCAs and CARs. If fueling and/or storage of hazardous materials are needed within RCAs or CARs, those sites must be reviewed and approved by the District Hydrologist or Aquatic Biologist. Additional protection measures, such as containment devices, may be necessary.
BMP 2-13 Control of Construction and Maintenance Activities Adjacent to SMZs: To protect water quality by controlling construction and maintenance actions within and adjacent to SMZs so that SMZ functions are not impaired.	Construction and maintenance fills, sidecast, and end-hauled materials will be kept out of SMZs except at designated crossing sites to minimize the effect to the aquatic environment.
BMP 2-14 Controlling In-Channel Excavation: To minimize stream channel disturbances and related sediment production.	There will be no in-channel or streambank excavation during any phase of project activities unless authorized by the district hydrologist or aquatic biologist.
BMP 2-16 Stream Crossings on Temporary Roads and Skid Trails:	Mechanical equipment crossing of perennial and intermittent (generally class I – III) streams is not permitted unless approved by the district hydrologist or aquatic biologist. Ephemeral streams (stream class IV and V) may be crossed at designated locations as agreed upon by the sale administrator and purchaser. Designate skid trails to avoid stream crossings and SMZs wherever possible. Designated crossings must be as perpendicular to the channel as possible and avoid sensitive soils and riparian vegetation damage. Stream banks must be repaired upon completion of the project.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 2-19 Disposal of Right-of-Way and Roadside Debris: To ensure that organic debris generated during road construction is kept out of streams so that channels and downstream facilities are not obstructed.	If slash generated by road work is disposed of within SMZs, it will be piled and burned or chipped. Material may also be removed from the SMZ for disposal.
BMP 2-21 Water Source Development Consistent with Water Quality Protection: To supply water for roads and fire protection while maintaining existing water quality.	Water drafting will not occur in streams when the base discharge is less than 1.5 cfs, and will not draft more than 50% of the ambient discharge over 1.5 cfs. New drafting sites shall be approved by the District Hydrologist or Fisheries/Aquatic Biologist and located to minimize sediment and maintain riparian resources, channel condition, meadow integrity, and aquatic species viability and habitat. Approaches will be as near perpendicular to the stream as possible and will be gravel surfaced or otherwise stabilized. If water-drafting is required, pumps with low entry velocity and suction strainers with screens less than 2 mm in size (1/8 in.) will be used.
BMP 2-22 Maintenance of Roads: To maintain roads in a manner that provides for water quality protection by minimizing rutting, failures, sidecasting, and blockage of drainage facilities, all of which can cause erosion, sedimentation, and deteriorating watershed conditions.	Roads needed for project activities will be brought to current engineering standards of alignment, drainage, and grade before use, and will be maintained through the life of the project. Roads will be inspected at least annually to determine what work, if any, is needed to keep ditches, culverts, and other drainage facilities functional and the road stable.
BMP 2-23 Road Surface Treatment to Prevent Loss of Materials:	Surface stabilization will be considered where grades exceed 12% or road is within riparian conservation areas.
BMP 2-24 Traffic Control During Wet Periods: To reduce road surface disturbance and the rutting of roads, and to minimize sediment washing from disturbed road surfaces.	On roads not designated for all weather or winter haul, heavy equipment operations will be limited until the period after the soil has dried in the top 12 inches in the spring.
BMP 2-26 Obliteration or Decommissioning of Roads: To reduce sediment generated from temporary roads, unneeded system and non-system roads by obliterating or decommissioning them at the completion of the intended use.	Temporary roads will be obliterated after serving their intended purpose for this project. This includes: (1) road effectively barricaded; (2) road effectively drained by measures such as re-contouring or outsloping to return surface to near natural hydrologic function; (3) a well distributed mulch or organic cover provides at least 50% cover, or road surface is revegetated using local native species; (4) sideslopes are reshaped and stabilized to match the natural contour (as necessary); and (5) stream crossings are removed and natural channel geometry is restored. If non-local mulch is used (such as straw), it must be approved by the Forest Service as weed free.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 5-8 Pesticide Application According to Label Directions and Applicable Legal Requirements: To avoid water contamination by complying with all label instructions and restrictions for use.	This BMP requires glyphosate applicators to strictly adhere to pesticide label instructions.
BMP 5-11 Cleaning and Disposal of Pesticide Containers and Equipment: To prevent water contamination resulting from cleaning or disposal of pesticide containers.	The cleaning and disposal of glyphosate containers will be done in accordance with Federal, State, and local laws, regulations and directives.
BMP 5-12 Streamside Wet Area Protection During Pesticide Spraying: To minimize the risk of pesticide inadvertently entering waters, or unintentionally altering the riparian area, SMZ, or wetland.	When spraying glyphosate, an untreated strip of land and vegetation will be left alongside surface waters, wetlands, riparian areas, or SMZ. Strip widths established by the IDT are 5 feet for dry channels and 25 feet for flowing channels (see Herbicide Use design criteria).
BMP 6-1 Fire and Fuel Management Activities: To reduce public and private losses and environmental impacts which result from wildfires and/or subsequent flooding and erosion by reducing or managing the frequency, intensity and extent of wildfire.	The project action alternatives are designed to achieve the desired conditions of BMP 6-1.
BMP 6-2 Consideration of Water Quality in Formulating Fire Prescriptions: To provide for water quality protection while achieving the management objectives through the use of prescribed fire.	Prescribed burning is planned at the minimum intensity and severity necessary to achieve management objectives, and each Burn Plan will incorporate all relevant design measures from this EIS.
BMP 6-3 Protection of Water Quality from Prescribed fire Effects: To maintain soil productivity, minimize erosion, and minimize ash, sediment, nutrients, and debris from entering water bodies.	Fires will be allowed to back into riparian vegetation, but direct lighting within riparian vegetation will not occur. All fire lines within RCAs and CARs will be water barred per BMP 1-17 spacing requirements. Fire lines within RCA (i.e., 150 ft., seasonal streams, and 300 ft. perennial streams, springs, and meadows) will be designed and constructed to reduce sediment entry into channels. Fire lines in RCAs will cross perpendicular to streams and follow the natural landscape contour as much as possible. Firelines within the SMZ will be hand cut. Waterbars will be placed on either side of each stream crossing to prevent or reduce sediment entry into streams.

BMP Name, Objective, and Direction	Application to the Sugar Pine Project
BMP 6-5 Repair or Stabilization of Fire Suppression Related Watershed Damage: To stabilize all areas that have had their erosion potential significantly increased, or their drainage pattern altered by suppression related activities.	In the event of a wildfire, protection of resources would be evaluated under the Burned Area Emergency Response, assessment and treatment Implementation protocol.
BMP 6-6 Emergency Rehabilitation of Watersheds Following Wildfires: To minimize as far as practicable: 1.) loss of soil and onsite productivity; 2.) overland flow, channel obstruction and instability; 3.) threats to life and property both on-site and off-site	In the event of a wildfire, protection of resources would be evaluated under the Burned Area Emergency Response, assessment and treatment Implementation protocol..
BMP 7-3 Protection of Wetlands: To avoid adverse water quality impacts associated with destruction, disturbance, or modification of wetlands.	Ground disturbing activities will not occur in wetlands or meadows.
BMP 7-4 Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Containment and Countermeasure (SPCC) Plan: To prevent contamination of water from accidental spills.	A spill contingency plan and spill prevention and countermeasure plan (SPCC) must be prepared if hazardous materials (including fuels and oils) stored on the Sierra National Forest exceed 1320 gallons, or if a single container exceeds 660 gallons. The plan will at a minimum include: the types and amounts of hazardous materials located in the project area, pre-project identified locations for hazardous materials storage and fueling/maintenance activities (must be located outside of RCA and CAR unless prior approval by District Hydrologist or Aquatic Biologist is obtained), methods for containment of hazardous materials and contents of on-site emergency spill kit, and a contingency plan (including contact names with phone numbers) to implement in the event of a spill. The SPCC plan must be approved by the Forest Service prior to project implementation.

Appendix C – Sierra National Forest Interim Pacific Fisher Habitat Maintenance and Improvement Approach

Unpublished internal report, Sierra National Forest by Mark T. Smith, Kim Sorini-Wilson and Kevin Williams

Purpose and Background

The purpose of the Pacific fisher habitat maintenance and improvement approach is to create interim recommendations from forest staff sufficient to assure forest restoration through commercial and precommercial tree thinning, silvicultural activities such as mastication of small trees and brush, piling and burning of forest debris and prescribed fire have at most insignificant adverse effects on fisher habitat functionality and through most activities, enhance it.

Based on advice from the Regional Ecosystem Conservation Staff, this interim approach will be recommendations until completion and issuance of a Southern Sierra Fisher Conservation Strategy, currently anticipated towards the end of 2009. This Conservation Strategy will be created as a geographically specific application of the West Coast Fisher Conservation Strategy, currently under development. Adjustments to this interim approach may occur at any time in response to new best available science or large scale wildfire that affects a significant area of fisher habitat.

There are usually several objectives that are proposed for accomplishment by an individual project and lead to development of the purpose and need statement in a NEPA analysis. This interim approach is intended only to guide these analyses as they require recommendations on maintenance and improvement of fisher habitat functionality.

Objectives

1. Maintain and enhance fisher habitat functionality while applying a cautious but effective approach to forest restoration of which fuels management is a key component.
2. Maintain high levels of canopy cover in areas that are most important to fisher habitat functionality, CWHR MC4D and MC5D and riparian areas associated with perennial streams.
3. Provide for heterogeneity across the landscape by retaining shrub/understory patches and higher densities of 20 to 30-inch dbh trees when they are associated with clumps of larger trees (>30-inch dbh), and utilize opportunities to create small openings as they occur on the landscape and when not at the expense of the large tree clumps.
4. Strive to increase the extent, value, and contiguity of fisher habitat throughout the Forest (and perhaps beyond, to the north) to maximize population persistence and enable population growth.

Habitat Status

Following is the habitat status from the executive summary of "Final Report: Baseline Evaluation of Fisher Habitat and Population Status in the Southern Sierra Nevada" (2007) by the Conservation Biology Institute which is available at www.consbio.org:

Baseline Habitat Assessment - Our analyses corroborate existing published descriptions of the current state of fisher habitat in the southern Sierra Nevada, and provide some new insights and additional tools for assessing current as well as future conditions. Fisher habitat in the southern Sierra Nevada is restricted to a relatively narrow band of mid-elevation forests, mostly on the western slope of the range, particularly on mesic topographic positions (i.e., slopes experiencing relatively low annual exposure to solar radiation), and especially where older stands of mixed conifers, sequoia, or ponderosa pine tend to abut or intermix with montane hardwoods, especially black oak. The zone of predicted suitable habitat broadens in more northerly portions of the study area (Stanislaus NF), although this area is not currently occupied by fishers.

Predicted coarse-scale fisher habitat is broken into somewhat discrete blocks or segments, with gaps generally corresponding to major river canyons. Some of these segments are occupied (south of the Merced River) whereas others (north of the Merced) are not. Among the occupied segments, the one comprising parts of the Kings River Administrative Study Area (between the Kings and San Joaquin Rivers) appears to be particularly vulnerable to disruption, as it is a relatively long and narrow stretch of variable but mostly moderate quality habitat according to our models. None of the FIA plots in that area have very high resting microhabitat value, although the sample size is small (~22). Highly suitable resting microhabitats are relatively rare even within areas of predicted suitable habitat at the coarse scale.

Much of the predicted suitable habitat on Sequoia and Sierra NF (roughly 192,000 ha total) appears to be occupied by fishers, whereas large areas of predicted suitable habitat on the Stanislaus NF (about 84,000 ha) are not.

Habitat monitoring relies on tracking changes in habitat quality using a combination of remotely-sensed vegetation data and plot data collected in conjunction with the ongoing Forest Inventory and Analysis program. Habitat monitoring on the Sierra and Sequoia is being conducted in collaboration with the Pacific Southwest Research Station (R5 Status and Trend Monitoring).

Population Status

Following is the population status from the executive summary of "Final Report: Baseline Evaluation of Fisher Habitat and Population Status in the Southern Sierra Nevada":

Baseline Population Assessment - Equilibrium population estimates from the population dynamics model PATCH were relatively insensitive to assumptions about initial population size, dispersal distance, and most age-specific fecundity and survival rates, but were highly affected by territory size and survival rates for adult females. Based on the most biologically defensible ranges of parameter values, we estimate that currently occupied habitat areas in the southern Sierra Nevada can support about 71-147 adult females (the most critical sex-age class for sustaining a population). Assuming a 1:1 sex ratio (which probably overestimates the number of adult males) yields an estimate of 142-294 adults fishers. Accounting for subadult animals provides a rough estimate of 220-360 total fishers in the southern Sierra Nevada. Although this estimate accords reasonably well with other estimates of the Sierra Nevada fisher population, it has several important sources of uncertainty and should be viewed with caution. We suspect that several assumptions may tend to inflate this estimate (e.g., assumed 1:1 sex ratio, average territory sizes of 860-1,200 ha, optimistic age-specific fecundity and survival rates, and no accounting for increased mortality during dispersal). On the other hand, the under-representation of habitat value for Kern Plateau and Sequoia-Kings Canyon NP may tend to slightly underestimate the total population.

Extrapolating fisher density estimates supplied by Jordan (2007) over our modeled habitat area (using the 0.5 cutpoint in probability of occupancy for model LAND14 south of the Merced River) yielded population estimates of 57-86 adult females and 285-370 total fishers. Although this estimate accords fairly well with those from PATCH and other methods, it is a very uncertain calculation, because (1) we are extrapolating density from only a single sample location, which may not be representative of density over the entire area; (2) using a single probability cutpoint to define occupiable habitat is overly simplistic; and (3) the extrapolation area includes small and isolated areas of predicted habitat that are probably not occupied.

Finally, the preliminary estimate supplied by R. Truex (personal communication) by applying sampling theory to the fisher monitoring data is 160-250 total fishers in the study area. This also matches fairly closely with our estimate using PATCH.

PATCH results suggest that potential source habitat (where births exceed deaths) are fairly well distributed in association with the larger, more contiguous areas of predicted high-value habitat, with sink habitats (deaths exceed births) in more peripheral and isolated habitat areas (Figure ES-3). The Kings River study area, between the San Joaquin and Kings Rivers, appears to be a fairly narrow and tenuous set of territories relative to more contiguous blocks of high-value habitat north and south of there. This area should be managed to prevent loss or further fragmentation of habitat value and to increase the contiguity of dense, older forest stands. Overall, forest management should strive to increase the size and connectivity of source habitat areas.

The FS Pacific Southwest Region (R5) Status and Trend Monitoring of fisher population involves two components: intensive sampling on Sierra and Sequoia National Forests (the portion of the Sierra Nevada currently occupied by fisher) designed to monitor population trend and additional sampling at 'sentinel sites' in the central and northern Sierra (the area assumed to be unoccupied by fisher) focused on documenting population expansion.

Population monitoring data have been used to develop habitat models for fisher that will be used to explore relative effects of different land management approaches on fisher habitat in the southern Sierra. Population monitoring involves conducting presence/ absence surveys throughout the region to estimate the proportion of sites (primary sample units) annually occupied by fisher and marten, and detecting declines over the proposed 10 year monitoring period.

Population monitoring program, sampling effort for both species (fisher and marten) has been greater in Sequoia and Sierra National Forests (672 sample units) than in the central and northern Sierra Nevada (244 sample units). Fishers have been detected at 103 locations during 181 different sampling occasions. Continued monitoring will be critical not only to understand trends in the southern Sierra fisher population, but also to document fisher population expansion into the central and northern Sierra Nevada should it occur. By June 2008, the first formal analysis of fisher population status and trend should be complete (R5 Status and Trend Monitoring).

The PSW Kings River Fisher Project and the parallel University of California Sierra Nevada Adaptive Management Project (UC SNAMP) fisher study are designed to monitor changes in the distribution of fishers in the Sierra Nevada and detect potential regional declines in fisher abundance. As a collaborative regional approach, these research projects will provide larger sample sizes, will facilitate a better understanding of the cause and effect relationship between fishers and their environment and will lead to management recommendations.

On the High Sierra Ranger District, PSW reported capturing a total of 25 fishers 13 females and 12 males from February 2007 to February 2008, all of which were fitted with radio collars. To

date, there have been 6 confirmed mortalities, 5 due to predation. Four necropsies have been completed and coyote and bobcat have been confirmed as predators. Seven of ten adult females appeared to have reproduced in 2007.

On the Bass Lake Ranger District, UC SNAMP reported nine individual fishers have been captured and radio collared since December 23, 2007. One of the nine radio collared fishers was struck and killed by a vehicle on Highway 41 adjacent to the Miami Motorcycle Area in late February, 2008. They are currently monitoring 8 radio collared fisher by regular aerial radio telemetry and ground-based telemetry. As of late February, 2008, automatic cameras have been used to survey 90 different 1 km^2 grid cells, primarily within the Nelder Creek, Sugar Pine, and White Chief Branch watersheds. Fisher activity has been detected in 51 of the grids surveyed so far.

Landscape Level Predicted Probability of Fisher Occupancy

The following map from "Final Report: Baseline Evaluation of Fisher Habitat and Population Status in the Southern Sierra Nevada" (2007) by the Conservation Biology Institute shows the predicted probability of fisher occupancy by twenty percent classes (value: 0 to 0.2, 0.2 to 0.4, etc.).

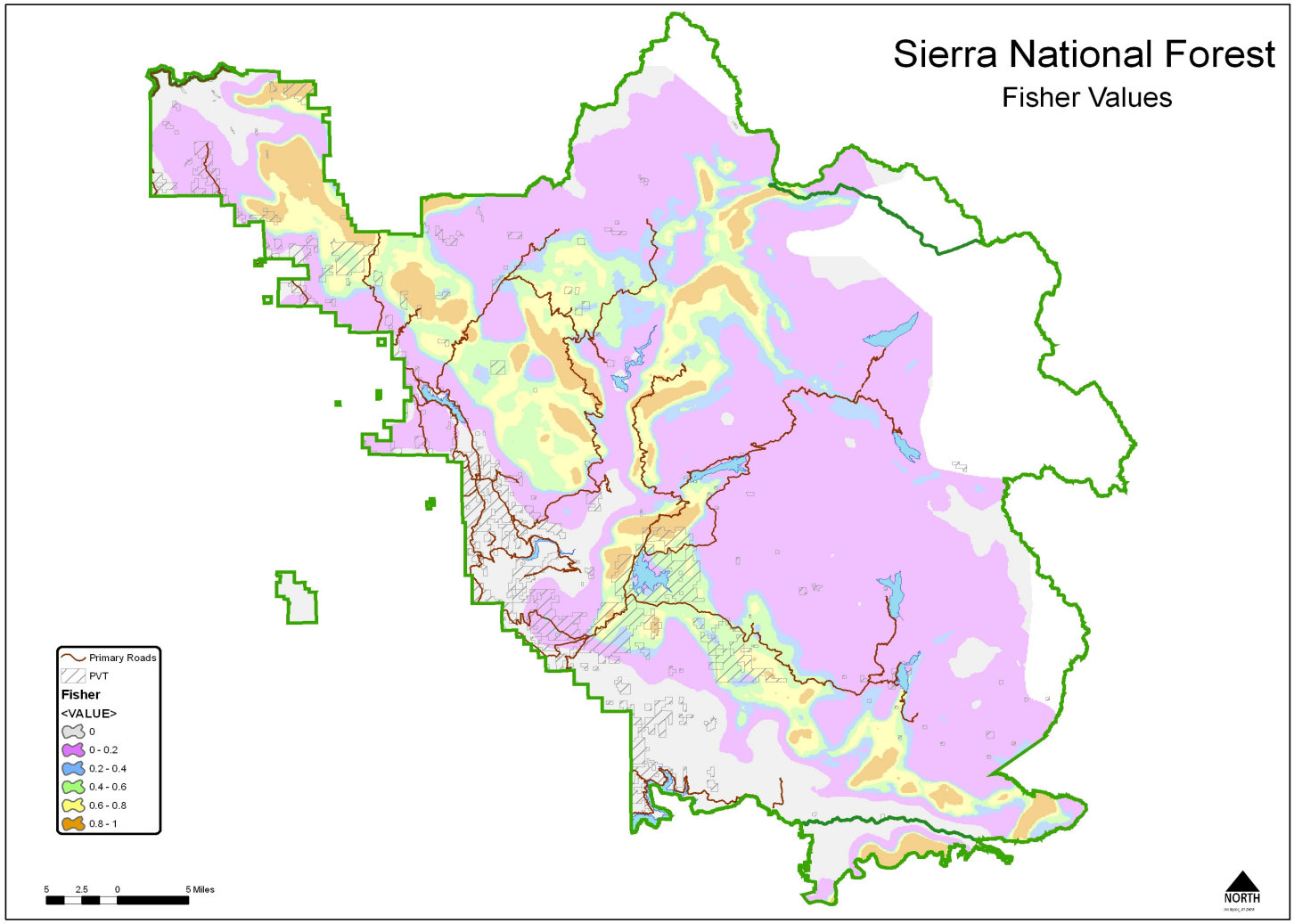


Figure 3. Predicted probability of fisher occupancy by twenty percent classes

New Information

New information and clarification related to the Pacific fisher are contained in two documents: (1) "Final Report: Baseline Evaluation of Fisher Habitat and Population Status in the Southern Sierra Nevada" (2007) referred to above; (2) "Lessons Learned Regarding Fisher Habitat Maintenance and Development" by Cheryl Carrothers and Diane Macfarlane (12/11/2007).

A new paper titled An Ecosystem Management Strategy for Southern Sierra Mixed-Conifer Forests by North, M., P. Stine, K. O'Hara, W. Zielinski and S. Stephens addresses that:

> *In recent years, there has been substantial debate over the appropriate management of Sierran forests and this debate inevitably cites "sound science" as a necessary foundation of any approach chosen. The intention of this paper is to propose a management strategy based on recent research findings and opportunities to implement new forest management practices in southern Sierran mixed-conifer forests. Many relevant research projects have published findings in dozens of scientific outlets, yet these have rarely been synthesized or presented in a form that speaks directly to current land management challenges.*
>
> *Objectives of forest management also invariably cite a "healthy forest" as one of the primary purposes of whatever strategy that is chosen. It is difficult, however, to define forest health, and as a broad concept its implementation will vary depending on the management objectives and ecological conditions that a given area is capable of supporting. A premise of silviculture is that forest management prescriptions can be tailored to fit a wide variety of land management objectives, once those objectives are defined. Thus in this paper, we summarize some of the key forest management objectives on National Forest lands in the southern Sierra and how they might be approached through particular silvicultural prescriptions.*

All the forgoing new information and clarification related to the Pacific fisher raises the question how it would modify the proposed action for the Sierra Nevada Adaptive Management Projects at Sugar Pine and Fish Camp and the implementation of the Reduction of Tree Harvest Size Alternative in the Kings River Project FEIS. To address these questions, principles have been drawn from the three documents with new information and the following table created to indicate how each principle would be implemented and the monitoring of that implementation on these projects. There is a need to validate that the project design measures applied the principle and that project implementation was consistent with what was designed.

Maintenance and Improvement Principles and Implementation Approaches

Table 35. Landscape Level Habitat Maintenance and Improvement Principles and Implementation Approaches

Principle	Implementation Approach	Monitoring
Recognize there is a band of fisher habitat running from the southeast to the northwest through the Sierra National Forest between about 4500 and 6500 foot elevation that varies in width and within which there is a high probability of detecting fisher. At some places (i.e. the Kings River Project) this band narrows enough that it becomes a focal area for increasing habitat functionality (quality, quantity and distribution) so that fisher movement is not restricted (CBI Final Report).	Strive to increase the value, extent, and connectivity of fisher habitat between the Kings and San Joaquin Rivers. (CBI Final Report). Advance opportunities to reduce the risk of catastrophic fire breaking this band by focusing fuels management especially on the southwestern and somewhat on the northeastern landscape. Particularly in the southwest are the areas to sparingly reduce crown bulk density and increase tree crown separation in conjunction with reducing ground and ladder fuels to increase the effectiveness of fuel treatments. Advance projects in the WUI that are southwest of the band of fisher habitat and/or create stewardship contracting opportunities (i.e. Jose Central and West of Shaver on High Sierra, Initial Fireshed priorities on Bass Lake).	Applicable monitoring is beyond the life of this Interim Approach.
Allow piling and burning of activity fuels and prescribed fire to be considered for inclusion in the purpose and need in any project in any area of the landscape outside of wilderness. Prescribed fire, should consider effects to large downed logs and snags. These important features should be retained wherever possible. However, the distribution of such features is spatially quite variable and need not be implemented uniformly across the landscape. When stands cannot be burned, reducing fuels to moderate fire behavior is still a key priority because wildfire is likely to burn the area eventually. (PSW EMS)	Establish and maintain a pattern of area treatments that is effective in modifying fire behavior so that it interrupts fire spread and achieves conditions that reduce the size and severity of wildfire.	Established permanent plots to monitor prescribed burns using the Browns Planar Intercept Method.

Principle	Implementation Approach	Monitoring
The frequency distribution of tree diameters in Sierran mixed conifer forest subject to frequent low-intensity fire was highly variable but generally flat due to periodic episodes of fire induced mortality and subsequent recruitment. Treatment of stands would strive to significantly reduce the proportion of small trees and increase the proportion of large trees as compared to what is currently found in contemporary stands. A large proportion of the growing space would be allocated to the largest tree stratum. (PSW EMS)	During the time this interim approach will remain in effect, flat frequency distributions of tree diameters for use as growing space allocation targets will be under development for the different forest types (i.e. mixed conifer, ponderosa pine). Until they are completed and ready for use, traditional uneven-aged or thinning from below growing space allocation targets will continued to be used. For the Kings River Project a modified version of the J-curve, covering only diameters from 11 to 30-inch, that emphasizes reducing the proportion of small trees and increasing the proportion of large trees in a stand, as encouraged in PSW EMS, has been described and will be utilized.	Not Applicable
Marking rules are based on crown strata or age cohorts (a proxy for size/structure cohorts) and species rather than uniform diameter limits applied to all species. (PSW EMS)	Also, during the time this interim approach, the MultiAge Stocking Assessment Model, referred to in PSW EMS, will be under development. Until it is ready for implementation, traditional approaches to writing markings rules (i.e. crown canopy and/or basal area targets) and a list of species to favor retaining will continue to be used.	Not Applicable

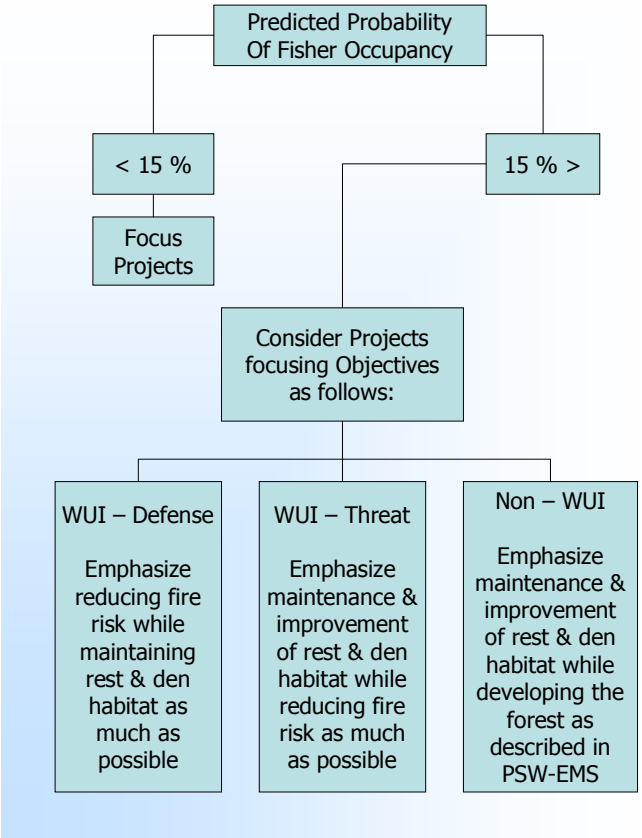
Principle	Implementation Approach	Monitoring
Plan the timing and emphasis of restoration projects using the following decision tree:  	In habitat that appears to support high densities of fisher based on current research and/or are outside of the WUI - Defense (i.e. Bear-fen); postpone the commercial thinning portion of projects. Advance projects involved in the KREW and/or the WUI - Defense, especially if they have little or no current fisher population (i.e. KREW Bull, El-O-Win, KREW Prov). Recognize opportunities to improve fisher habitat functionality through restoration projects, especially in areas with a less than 40 % probability of detecting fisher, which can be accomplished by favoring development of large trees, diverse structure and retaining endemic levels of natural processes (insects, disease, wind damage, etc.).	Applicable monitoring is beyond the life of this Interim Approach

Table 36. Plant Aggregation Level Habitat Maintenance and Improvement Principles and Implementation Approaches

Principle	Implementation Approach	Monitoring
In the mixed conifer type, hardwoods and pines, with much lower densities in current forest compared with historical distributions, would rarely be thinned. The emphasis of thinning would be focused on firs and incense cedar. This would restore a more balanced distribution of tree species that was typical of active-fire conditions (PSW EMS). In the ponderosa pine type, this principle only applies to retention of hardwoods.	Silvicultural prescriptions will specify a list of tree species to favor retaining stand by stand.	As part of the timber sale preparation package, provide a comparison by tree species of the number of trees to remain after thinning versus found present by the initial stand examination for review with interested parties.
Trees within a stratum (i.e. canopy layers or age cohorts) would often be clumped, but different strata, for fuels reasons, would often be spatially separated horizontally across a stand (PSW EMS). Minimize the application of silvicultural prescriptions that produce homogenous residual stands, with attention to maintaining heterogeneity at multiple scales. Heterogeneous habitats expressed at multiple scales are more desirable than homogenous stands/landscapes. Available resting/denning structure is generally considered to be limiting. In stands lacking vegetative and structural diversity in the understory, prey abundance and distribution may be limited. Creation of small openings, usually less than a quarter acre, may encourage the development of shrubs which typically contribute to the diversity of food sources. (Lessons Learned)	Retain higher basal area than otherwise prescribed in areas where large trees (>30-inch dbh) are clumped with 20 to 29-inch trees interspersed. Increase the basal area target to approximately 80 percent of full stocking in these clumps. Where large trees have been depleted or do not exist manage the next largest size so that they will grow into large trees and provide structural components for fisher and owl resting and roosting structures. Retain some patches of understory shrub, hardwoods and small trees across the stand with a rough target of 10 to 15% of the area to be harvested. (Cedar Valley)	Conduct a field review with interested parties to visually examine the results after the commercial thinning phase of the project is completed then again after the cultural and fuels treatments have been completed.

Principle	Implementation Approach	Monitoring
Trees providing suitable structure for wildlife include large trees, trees with broken tops, trees with cavities, trees with platforms, and other malformations that create structure for nests, dens, etc. are suitable nest, den and rest sites for wildlife. These structures typically occur in the oldest trees. Highly suitable resting microhabitats are relatively rare even within areas of predicted suitable habitat at the coarse scale. Management should strive to increase the distribution and abundance of forest stands that provide high-value resting sites and hopefully denning sites (Zielinski et al. 2004a, 2006, Aubry and Raley 2006) especially within areas predicted to be high value at the coarse-scale. (CBI Final Report).	A process for identifying and thus protecting trees providing suitable structure for wildlife has been developed for the Kings River Project with the technical advice of the Fish and Wildlife Service. It will be adopted for application across the Forest (PSW EMS). (The process is essentially the same approach referred to in PSW EMS as being used by Green Diamond.) Natural process such as endemic levels of insect and disease activity, wind damage on a small scale and low intensity fire help in developing suitable tree structure for wildlife. So, the importance of these natural processes will be recognized and defective medium and large size trees will not be targeted for elimination in silvicultural prescriptions when they occur in clumps identified as described in the previous section or along riparian corridors as described in the following section.	As part of the timber sale preparation, GPS the location of trees considered for protection using the process developed for the Kings River Project. Provide a comparison of the number considered versus the actual number selected for protection for review with interested parties.
Mesic conditions found along riparian corridors (600 feet in total width) associated with perennial streams as well as north and northeast-facing slopes contribute to greater site quality for tree growth and structure development. Mesic sites also tend to have greater biodiversity and greater biomass per area, providing better foraging habitat as well. Because these sites provide greater opportunity for developing the structural elements, large trees and dense canopy cover components of fisher denning and resting habitat faster, consider proposing treatments that support this type of stand development within and adjacent to the more mesic sites over other drier, less productive sites. (Lessons Learned)	Retain greater than 60% canopy cover in habitat classified as CWHR MC4D and MC5D by aerial photo interpretation (Cedar Valley), especially within and adjacent to the more mesic sites over other drier, less productive sites. Along perennial streams, leave the first 50 feet from the high water mark undisturbed, except an underburn would be allowed to back into this zone; limit conifer thinning from 50 to 150 feet to trees 12-inch diameter or less; emphasize retention of canopy cover as described above from 150 to 300 feet.	Design for each project using the Cedar Valley approach as a guide.

<table>
<tr><th>Principle</th><th>Implementation Approach</th><th>Monitoring</th></tr>
<tr>
<td>Enhance patches of 20 to 30-inch diameter trees by thinning so that the remaining trees will grow faster into trees greater than 30-inch diameter and reduce the risk of insect induced mortality in these patches.</td>
<td>Using the approach of emphasizing what is left in a treated stand, rather than what is removed (PSW-EMS), the following are the desired no. of trees per acre by diameter classes for an average condition across several acres of a stand:
<table>
<tr><th>Site Quality</th><th colspan="4">Average No. Trees per Acre by Diameter</th></tr>
<tr><td></td><td>18 to 21.9-inch</td><td>22 to 25.9-in</td><td>26 to 29.9-in</td><td>30-inch +</td></tr>
<tr><td>High</td><td>10</td><td>7</td><td>5</td><td>11</td></tr>
<tr><td>Moderate</td><td>8</td><td>6</td><td>4</td><td>9</td></tr>
</table>
</td>
<td>As part of the timber sale preparation package, provide a comparison by diameter class of the number of trees to remain after thinning versus found present by the initial stand examination for review with interested parties.</td>
</tr>
<tr>
<td>To provide for species and structural diversity to maintain or enhance habitat suitability, retain large hardwoods, specifically black oaks, as available.</td>
<td>Two different oak management strategies described below may be applied, depending on overall availability of oaks and site specific objectives:

1. When the objective is to maintain the health and/or extend the overall longevity of a particular oak, smaller, competing conifers may be removed to allow the oak better access to sunlight and other nutrients even though many of these oaks will not “release” (have a growth spurt) as a result of the thinning.

2. When the objective is to maintain the dark, closed canopy microclimate around a medium or large oak (usually about 20-inch diameter), retention of the smaller, competing trees may be warranted. Favored rest and den trees are utilized not just for the potential access to cavities they provide, but also for the high density of surrounding, adjacent trees. This guidance does not apply to the Defense Zone of the WUI or to fuelbreaks.</td>
<td>As part of the timber sale preparation package, provide a tally of black oaks treated by the two different oak management strategies for review with interested parties.</td>
</tr>
</table>

Appendix D – Data Tables for Sugar Pine Adaptive Management Project

Sugar Pine Plot Data Summary Table

Existing and Proposed Action Conditions

The Sugar Pine plot data summary table displays plot data collected within the proposed treatment areas displayed on the Sugar Pine EIS map. Variable plots were taken using a 30 Basal Area Factor prism. Trees less than 4 inches dbh were not sampled (4 inches was the smallest diameter being considered for biomass treatments). Due to the wide variability of vegetation present within these proposed treatment areas and the project as a whole, plots representing similar stand conditions were grouped together by proposed treatment area. It would be misleading to display an average for the project area. The column labeled "No. Plots" displays the number of plots within each grouping. Although plots were taken within specific potential treatment areas, similar stand conditions may be present in other areas as well. Plot conditions varied widely from a basal area low of 90 ft^2 to 510 ft^2 per acre. Plot data recorded variations in trees 4 inches dbh and larger per acre from 15 to over 1000. In some plots no small trees were captured in the sample while in others hundreds per acre were. Several plots represent "groupings of conifers with increased BA retention (20 to 30-inch dbh)" similar to those retained in the Cedar Valley project area.

The term "light" which accompanies a number of the proposed treatment areas refers to those areas/plots where the basal area present is generally light and would result in minimal removal of trees 10 inches dbh and larger. Although an area may be designated as "light" due to lighter basal areas present, there may still be a need to treat heavily stocked pockets of smaller diameter trees (less than 4 inches dbh) that may not have been sampled during the sampling process.

The majority of the Sugar Pine project area was heavily railroad logged between 1918 and 1924. Logs were processed at the mill at Sugar Pine. The 1944 aerial photos provide a graphic display of the extent of that activity. In some areas scattered older trees were left following logging. The vast majority of conifers present today were seedlings and saplings present in the understory that survived the logging entry. Except for the 40 year old pine plantation adjacent to Road 6S07, a small pine plantation along Road 5S79, and a couple of others in the Big Sandy area, stands proposed for treatment average 90 to 110 years of age. Overall average site quality sampled is a Dunning 1.

Plot data indicates that the majority of the stands within the area surrounding Sugar Pine are a pine type that is quite heavy to the more shade tolerant, but fire prone, incense cedar. In this area, mixed conifer stands where white fir is a significant component, are found in only a few locations, predominantly near cooler, more moist, draws. White fir stands mixed with red fir and pines comprise a large proportion of the stands in the smaller subwatershed being studied near Big Sandy as a part of the hydrology portion of the project. Crown Closures present were taken from the data sheets with a reduction made for crown overlap. Suppressed trees were not included as part of the existing crown closure.

The plot data and summaries shown provide insight into the variability of the vegetation present within the proposed treatment areas. During collection of the plot data, trees that might be selected for removal under the proposed thinning prescription for that species composition were noted. From that data, potential leave and cut basal area, leave and cut tree sizes and numbers and

existing and post harvest crown closures were determined. On a number of plots, for various reasons, leave basal area exceeds targets for that species composition.

Legend for Sugar Pine Plot Data Summary Tables

Location

Number Corresponds to the Treatment Area Number on Project Map

(MC) represents an area that is considered a Mixed Conifer dominated stand

(plt) represents a pine plantation

(WF) represents an area that is considered a White Fir dominated stand

Remainder are considered pine dominated stands

Species Composition

PP – Ponderosa Pine

SP – Sugar Pine

WF – White Fir

RF – Red Fir

IC – Incense Cedar

OK – Oak

Crown Closure

Given in percent (reduced for crown overlap). CWHR relationship for crown closure designation.

P: 25-39%

M: 40-59%

D: 60% +

Desired leave Basal Area for comparison

Pine dominated stands = 150-180 ft^2 per acre

Mixed Conifer (MC) dominated stands = 210 ft^2 per acre

White Fir (WF) dominated stands = 240 ft^2 per acre

For Alternative 3 and 4 a surrogate of 10 inches dbh was used to display the changes that would occur based on only removing ladder fuels for each alternative. It is anticipated that some trees larger than 10 inches dbh that contribute to fuel ladders will be removed. Since these will be either intermediate or suppressed trees, overall crown closures following treatment will not change.

Age

Calculated from one sampled tree per plot. The majority of the conifers within the proposed treatment area are 90-110 years old.

Mean Diameter (Dia)

Calculated from trees within plots

Table 37. Sugar Pine Plot Data Summary, Existing and Proposed Action (Alternative 2) Conditions

Location	Species Composition						Age	Site	Trees 5-inch dbh and larger					Basal Area 5 inches and larger				Crown Closure		Mean Dia	No Plots
	PP	SP	WF	RF	IC	OK			Total	Cut 5-10	Cut 11-20	Cut 21-29	Leave	Total	Cut 5-20	Cut 21-29	Leave	Before	After		
3 light	86	0	0	0	14	0	90	1	102	0	38	0	64	210	30	0	180	64 (D)	64 (D)	19	1
3	34	3	14	0	38	10	84	1	111	0	37	14	60	290	60	40	190	89 (D)	66 (D)	22	3
4 light	37	3	11	0	47	3	112	1	109[B]	25	0	0	84	142[B]	7	0	135	42 (M)	42 (M)	15	8
4	34	6	0	0	47	13	98	1	216	74	73	12	57	320	100	30	190	97 (D)	83 (D)	16	3
4 Oak	8	0	0	0	31	62	87	1	66	0	0	0	66	130	0	0	130	88 (D)	88 (D)	12	3
5 light	73	9	18	0	0	0	86	1	62	0	0	0	62	165	0	0	165	39 (P)	39 (P)	22	2
6	62	8	15	0	15	0	134	1	73	0	0	0	73	195	0	0	195	56 (M)	56 (M)	22	2
6 MC	5	18	45	0	32	0	126	1	199	28	77	9	85	330	75	30	225	77 (D)	60 (D)	17	2
7 light	19	0	0	0	81	0	129	1	99[A]	0	30	6	63	225[A]	30	15	180	52 (M)	45 (M)	12	2
7	38	0	0	0	62	0	94	1	251	98	86	19	48	420	150	60	210	100 (D)	70 (D)	17	3
8 MC	6	6	47	0	42	0	107	1	117[A]	12	47	5	53	270[A]	52	15	203	57 (M)	48 (M)	21	4
8	46	17	0	0	25	13	120	1	231	124	38	16	53	360	105	45	210	100 (D)	78 (D)	16	2
8 light	33	17	0	0	50	0	107	1	101	0	0	0	101	180	0	0	180	53 (M)	53 (M)	18	1
10	74	5	0	0	21	0	120	1	136	0	65	3	66	285	75	15	195	88 (D)	60 (D)	20	2
10 light	25	4	14	0	50	7	100	1	240	90	5	0	145	210	30	0	180	68 (D)	61 (D)	12	4

Location	Species Composition						Age	Site	Trees 5-inch dbh and larger					Basal Area 5 inches and larger				Crown Closure		Mean Dia	No Plots
	PP	SP	WF	RF	IC	OK			Total	Cut 5-10	Cut 11-20	Cut 21-29	Leave	Total	Cut 5-20	Cut 21-29	Leave	Before	After		
12	0	50	10	0	40	0	65	1	71	0	0	27	44	300	0	90	210	59 (M)	52 (M)	28	1
14 MC	0	31	50	0	19	0	115	1	116	0	32	32	52	480	30	120	330	92 (D)	73 (D)	28	1
23 MC	31	0	63	0	6	0	83	1	112	0	14	48	50	480	30	150	300	100 (D)	70 (D)	28	1
30 plt	100	0	0	0	0	0	43	1	149	0	67	0	82	240	90	0	150	90 (D)	60 (D)	17	1
33 WF	0	5	50	45	0	0	113	1	138	37	46	5	50	320	65	15	240	53 (M)	45 (M)	20	6
34 light WF	0	0	80	20	0	0	100	1	69	0	0	0	69	240	0	0	240	45 (M)	45 (M)	25	2

[A] Plus 172 4-inch dbh trees/acre (15 ft^2) to be removed (not included in totals)

[B] Plus 86 4-inch dbh trees/acre (7.5 ft^2) to be removed (not included in totals)

Table 38. Sugar Pine Plot Data Summary, Existing and Alternative 3

Location	Species Composition						Age	Site	Trees 5-inch dbh and larger					Basal Area 5 inches and larger				Crown Closure		Mean Dia	No Plots
	PP	SP	WF	RF	IC	OK			Total	Cut 5-10	Cut 11-20	Cut 21-29	Leave	Total	Cut 5-20	Cut 21-29	Leave	Before	After		
3 light	86	0	0	0	14	0	90	1	102	0	38	0	64	210	30	0	180	64 (D)	64 (D)	19	1
3	34	3	14	0	38	10	84	1	111	0	37	14	60	290	60	40	190	89 (D)	66 (D)	22	3
4 light	37	3	11	0	47	3	112	1	109[B]	25	0	0	84	142[B]	7	0	135	42 (M)	42 (M)	15	8
4	34	6	0	0	47	13	98	1	216	74	0	0	142	320	10	0	310	97 (D)	97 (D)	16	3
4 Oak	8	0	0	0	31	62	87	1	66	0	0	0	66	130	0	0	130	88 (D)	88 (D)	12	3
5 light	73	9	18	0	0	0	86	1	62	0	0	0	62	165	0	0	165	39 (P)	39 (P)	22	2
6	62	8	15	0	15	0	134	1	73	0	0	0	73	195	0	0	195	56 (M)	56 (M)	22	2
6 MC	5	18	45	0	32	0	126	1	199	28	77	9	85	330	75	30	225	77 (D)	60 (D)	17	2
7 light	19	0	0	0	81	0	129	1	99[A]	0	30	6	63	225[A]	30	15	180	52 (M)	45 (M)	12	2
7	38	0	0	0	62	0	94	1	251	98	86	19	48	420	150	60	210	100 (D)	70 (D)	17	3
8 MC	6	6	47	0	42	0	107	1	117[A]	12	47	5	53	270[A]	52	15	203	57 (M)	48 (M)	21	4
8	46	17	0	0	25	13	120	1	231	124	38	16	53	360	105	45	210	100 (D)	78 (D)	16	2
8 light	33	17	0	0	50	0	107	1	101	0	0	0	101	180	0	0	180	53 (M)	53 (M)	18	1
10	74	5	0	0	21	0	120	1	136	0	65	3	66	285	75	15	195	88 (D)	60 (D)	20	2
10 light	25	4	14	0	50	7	100	1	240	90	5	0	145	210	30	0	180	68 (D)	61 (D)	12	4

Location	Species Composition						Age	Site	Trees 5-inch dbh and larger					Basal Area 5 inches and larger				Crown Closure		Mean Dia	No Plots
	PP	SP	WF	RF	IC	OK			Total	Cut 5-10	Cut 11-20	Cut 21-29	Leave	Total	Cut 5-20	Cut 21-29	Leave	Before	After		
12	0	50	10	0	40	0	65	1	71	0	0	27	44	300	0	90	210	59 (M)	52 (M)	28	1
14 MC	0	31	50	0	19	0	115	1	116	0	32	32	52	480	30	120	330	92 (D)	73 (D)	28	1
23 MC	31	0	63	0	6	0	83	1	112	0	14	48	50	480	30	150	300	100 (D)	70 (D)	28	1
30 plt	100	0	0	0	0	0	43	1	149	0	67	0	82	240	90	0	150	90 (D)	60 (D)	17	1
33 WF	0	5	50	45	0	0	113	1	138	37	46	5	50	320	65	15	240	53 (M)	45 (M)	20	6
34 light WF	0	0	80	20	0	0	100	1	69	0	0	0	69	240	0	0	240	45 (M)	45 (M)	25	2

[A] Plus 172 4-inch dbh trees/acre (15 ft^2) to be removed (not included in totals)

[B] Plus 86 4-inch dbh trees/acre (7.5 ft^2) to be removed (not included in totals)

A small portion of Treatment Area 3 would only have fuel ladders removed under this alternative (effects not displayed in table).

Table 39. Sugar Pine Plot Data Summary, Existing and Alternative 4

Location	Species Composition						Age	Site	Trees 5-inch dbh and larger					Basal Area 5 inches and larger				Crown Closure		Mean Dia	No Plots
	PP	SP	WF	RF	IC	OK			Total	Cut 5-10	Cut 11-20	Cut 21-29	Leave	Total	Cut 5-20	Cut 21-29	Leave	Before	After		
3 light	86	0	0	0	14	0	90	1	102	0	0	0	102	210	0	0	21	64 (D)	64 (D)	19	1
3	34	3	14	0	38	10	84	1	111	0	0	0	111	290	0	0	20	89 (D)	89D)	22	3
4 light	37	3	11	0	47	3	112	1	109 [B]	25	0	0	84	142 [B]	7	0	135	42 (M)	42 (M)	15	8
4	34	6	0	0	47	13	98	1	216	74	0	0	142	320	10	0	310	97 (D)	97 (D)	16	3
4 Oak	8	0	0	0	31	62	87	1	66	0	0	0	66	130	0	0	130	88 (D)	88 (D)	12	3
5 light	73	9	18	0	0	0	86	1	62	0	0	0	62	165	0	0	165	39 (P)	39 (P)	22	2
6	62	8	15	0	15	0	134	1	73	0	0	0	73	195	0	0	195	56 (M)	56 (M)	22	2
6 MC	5	18	45	0	32	0	126	1	199	28	0	0	171	330	15	0	315	77 (D)	77 (D)	17	2
7 light	19	0	0	0	81	0	129	1	99[A]	0	0	0	99	225 [A]	0	0	225	52 (M)	52 (M)	12	2
7	38	0	0	0	62	0	94	1	251	98	0	0	153	420	40	0	380	100 (D)	100 (D)	17	3
8 MC	6	6	47	0	42	0	107	1	117 [A]	12	0	0	105	270 [A]	8	0	262	57 (M)	57 (M)	21	4
8	46	17	0	0	25	13	120	1	231	124	0	0	107	360	45	0	315	100 (D)	100 (D)	16	2
8 light	33	17	0	0	50	0	107	1	101	0	0	0	101	180	0	0	180	53 (M)	53 (M)	18	1
10	74	5	0	0	21	0	120	1	136	0	0	0	136	285	0	0	285	88 (D)	88 (D)	20	2
10 light	25	4	14	0	50	7	100	1	240	90	0	0	150	210	23	0	187	68 (D)	68 (D)	12	4

Location	Species Composition						Age	Site	Trees 5-inch dbh and larger					Basal Area 5 inches and larger				Crown Closure		Mean Dia	No Plots
	PP	SP	WF	RF	IC	OK			Total	Cut 5-10	Cut 11-20	Cut 21-29	Leave	Total	Cut 5-20	Cut 21-29	Leave	Before	After		
12	0	50	10	0	40	0	65	1	71	0	0	0	71	300	0	0	300	59 (M)	59 (M)	28	1
14 MC	0	31	50	0	19	0	115	1	116	0	0	0	116	480	0	0	480	92 (D)	92 (D)	28	1
23 MC	31	0	63	0	6	0	83	1	112	0	0	0	112	480	0	0	480	100 (D)	100 (D)	28	1
30 plt	100	0	0	0	0	0	43	1	149	0	0	0	149	240	0	0	240	90 (D)	90 (D)	17	1
33 WF	0	5	50	45	0	0	113	1	138	37	0	0	101	320	5	0	315	53 (M)	53 (M)	20	6
34 light WF	0	0	80	20	0	0	100	1	69	0	0	0	69	240	0	0	240	45 (M)	45 (M)	25	2

[A] Plus 172 4-inch dbh trees/acre (15 ft^2) to be removed (not included in totals)

[B] Plus 86 4-inch dbh trees/acre (7.5 ft^2) to be removed (not included in totals)

California Wildlife Habitat Relationships (CWHR)

Table 40. Sugar Pine CWHR Data, Main Project Area; Present Compared to Proposed Action (Alternative 2)

CWHR	Total Project Acres	Treatment Analysis Area Acres	Acres Before Treatments			Acres After Treatments			Total Project Acres After Treatments
			Tractor	Mastication[1]	Rx[2]	Tractor	Mastication[1]	Rx[2]	
MCH	6	1	0	0	0	0	0	0	6
MCP	38	24	0	19	0	0	19	0	38
MRI	1	0	0	0	0	0	0	0	1
MHW3M	5	1	0	0	0	0	0	0	5
MHW3D	27	15	0	0	0	0	0	0	27
MHW4M	81	15	3	7	0	3	7	0	81
MHW4D	**26**	**17**	**1**	**14**	**0**	**1**	**14**	**0**	**26**
MHC4P	23	23	13	5	0	13	5	0	23
MHC4M	62	50	15	26	0	15	26	2	64
MHC4D	**605**	**325**	**115**	**66**	**31**	**115**	**66**	**29**	**603**
MHC5D	**21**	**4**	**0**	**4**	**0**	**0**	**4**	**0**	**21**
PGS	3	3	0	3	0	0	3	0	3
PPN3P	6	6	1	5	0	1	5	0	6
PPN3M	16	14	5	8	1	42	8	1	53
PPN3D	186	186	167	19	0	130	19	0	149
PPN4S	8	6	0	0	0	0	0	0	8
PPN4P	56	40	40	0	0	40	0	0	56
PPN4M	312	261	136	93	0	136	93	1	313
PPN4D	**1429**	**762**	**314**	**210**	**11**	**314**	**210**	**10**	**1428**

CWHR	Total Project Acres	Treatment Analysis Area Acres	Acres Before Treatments			Acres After Treatments			Total Project Acres After Treatments
			Tractor	Mastication[1]	Rx[2]	Tractor	Mastication[1]	Rx[2]	
PPN5M	88	80	22	56	0	22	56	0	88
PPN5D	**17**	**7**	**5**	**0**	**0**	**5**	**0**	**0**	**17**
SMC3S	5	5	0	0	5	0	0	5	5
SMC3M	16	16	9	2	0	12	2	0	19
SMC3D	35	21	7	14	0	4	14	0	32
SMC4S	4	4	0	0	4	0	0	4	4
SMC4P	54	36	8	21	7	8	21	7	54
SMC4M	149	120	12	55	50	12	55	55	154
SMC4D	**1016**	**410**	**98**	**132**	**71**	**98**	**132**	**66**	**1011**
SMC5M	8	0	0	0	0	0	0	0	8
SMC5D	**30**	**6**	**0**	**4**	**2**	**0**	**4**	**2**	**30**
WFR4D	**9**	**7**	**1**	**0**	**6**	**1**	**0**	**6**	**9**
Total	**4342**	**2465**	**972**	**763**	**188**	**972**	**763**	**188**	**4342**

[1]Note: Acres Before and After Treatment for Mastication and Rx are gross acres

[2]Approximately only 65% of mastication acreage will be treated. Rx burning acreage % may be substantially less than shown

Table 41. Sugar Pine CWHR Data, Hydrology Study Area; Present Compared to Proposed Action (Alternative 2)

CWHR	Total Project Acres	Treatment Analysis Area Acres	Acres Before Treatments			Acres After Treatments			Total Project Acres After Treatments
			Tractor	Mastication	Rx	Tractor	Mastication	Rx	
MCP	27	2	0	0	2	0	0	2	27
BAR	16	2	0	0	0	0	0	0	16
JPN2S	34	32	0	32	0	0	32	0	34
JPN3P	24	24	6	16	0	6	16	0	24
JPN3M	45	45	39	6	0	44	6	0	50
JPN3D	5	5	5	0	0	0	0	0	0
SMC3S	7	3	2	0	0	2	0	0	7
SMC3P	33	2	0	0	0	0	0	0	33
SMC3M	8	6	3	0	0	3	0	0	8
SMC3D	7	0	0	0	0	0	0	0	7
SMC4S	14	14	1	1	4	1	1	4	14
SMC4P	23	12	8	1	1	8	1	1	23
SMC4M	78	65	36	6	8	36	6	8	78
SMC4D	**26**	**11**	**7**	**0**	**0**	**7**	**0**	**0**	**26**
SMC5S	4	4	4	0	0	4	0	0	4
SMC5M	65	65	48	3	3	48	3	3	65
SMC5D	**109**	**63**	**57**	**0**	**0**	**57**	**0**	**0**	**109**
RFR4S	5	5	5	0	0	5	0	0	5
RFR4P	33	33	10	23	0	10	23	0	33
RFR4M	22	16	9	2	5	9	2	5	22

CWHR	Total Project Acres	Treatment Analysis Area Acres	Acres Before Treatments			Acres After Treatments			Total Project Acres After Treatments
			Tractor	Mastication	Rx	Tractor	Mastication	Rx	
RFR4D	**9**	**3**	**0**	**3**	**0**	**0**	**3**	**0**	**9**
RFR5M	23	20	14	1	0	14	1	0	23
RFR5D	**51**	**19**	**13**	**0**	**0**	**13**	**0**	**0**	**51**
WTM	**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14**
Total	**682**	**451**	**267**	**94**	**23**	**267**	**94**	**23**	**682**

Table 42. Sugar Pine EIS Appraisal Cost Summary

	Alt 2	Alt 3	Alt 4
Sawlog CCF Volume	8383.8	6683.3	1497.9
Sawlog MBF Volume	4200.1	3378.2	690.9
Biomass CCF Volume	1394.6	1145.2	406.9
Biomass Green Ton Volume	7883.3	6428.8	1852.0
Sawlog Pond Value	**$1,477,390**	**$1,175,264**	**$261,045**
Sawlog Haul Cost	$601,118	$479,195	$107,399
Biomass Haul Cost	$94,915	$77,403	$22,298
Sawlog Stump to Truck Cost	$770,807	$628,500	$297,683
Biomass Stump to Truck Cost	$57,566	$57,517	$57,553
PreHaul Road Maintenance Cost	$12,266	$10,426	$2,010
During Haul Road Maintenance Cost	$14,708	$12,150	$5,371
Post Haul Road maintenance Cost	$24,336	$20,693	$3,988
Specified Road Construction Cost	$120,000	$120,000	$120,000
Specified Road Reconstruction Cost	$88,387	$88,387	$88,387
Road Surface Replacement Deposit	$19,141	$13,948	$3,139
Erosion Control - Waterbars Cost	$16,782	$16,782	$16,782
Erosion Control - Landings Cost	$1,715	$1,715	$1,715
PAL Cost	$21,567	$17,827	$7,918
Chipper and Operator Cost	$11,317	$11,274	$11,265
Present Net Value	**$(377,235)**	**$(380,554)**	**$(484,464)**