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Lake Tahoe Basin Management Unit South Shore Fuel Reduction and Healthy Forest Restoration EIS/EIR

Forest Supervisor's Office
Lake Tahoe Basin Management Unit
South Lake Tahoe, California 96150

South Shore from Heavenly Valley

DRAFT
ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT

Lake Tahoe Basin Management Unit
South Shore Fuel Reduction and Healthy Forest Restoration

El Dorado County, California

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Abstract: The Draft Environmental Impact Statement (DEIS) documents the analysis of three alternatives (1, 2, and 3) to manage fuel reduction and forest health in the wildland-urban intermix (WUI). Alternative 1 proposes no action; fuel loads would continue to increase and urban areas would remain at risk for high intensity wildfire. Alternative 2 would reduce hazardous fuel and improve forest health on 10,671 acres. Alternative 2 emphasizes thinning to change wildfire behavior from high intensity crown fires to low intensity surface fire by removing smaller trees that act as fuel ladders and increasing spacing between trees. Forest health would improve by reducing basal area to attain forest densities with improved resistance to drought, insects, and disease. More acres would use mechanical equipment, including within SEZs and wildlife areas than in Alternative 3. Alternative 3 was developed in response to public comments received on the Proposed Action during scoping to reduce impacts to watersheds and wildlife, while still reducing the risk of high-intensity crown fire. This Alternative reduces hazardous fuel and improves forest health in the WUI on 10,112 acres.

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Executive Summary

Introduction

The Lake Tahoe Basin Management Unit (LTBMU) proposes to reduce the risk of high intensity wildfire on National Forest Lands in the urban wildland intermix (WUI) in order to provide a defense zone between the Forest and urban and/or suburban development. Removing surface and ladder fuels in the WUI would provide space for an oncoming crown fire to drop to a surface fire where deployment of hand crews could be expected to succeed in controlling the spread of the fire. Thinning to achieve forest density more resistant to drought, insects, and disease is included in the action alternatives, along with removal of conifer encroachment in riparian areas, aspen, and meadows. Retention of the larger, more fire resistant trees and retention of the more fire and drought-resistant pine species would also improve the vegetative species distribution over the long term. The action alternatives are in compliance with, and would implement the direction in the LTBMU Forest Plan, including amendments.

Background

Project Area

The South Shore project analysis area extends from Cascade Lake on the northwest to the Heavenly Mountain Resort special use permit boundary and the Nevada State line on the northeast, and from Lake Tahoe on the north to the LTBMU boundary on the south. The table below lists the acres by ownership in the project analysis area.

Ownership	Acres
Total Project, all ownerships	86,790
Private Ownership	8,088
Water and Other (State, County)	8,121
National Forest Ownership	70,581

LTBMU Fuels and Healthy Forest Restoration Direction

The Healthy Forest Restoration Act of 2003 (HFRA) authorizes projects on federal lands to reduce fuel loads and increase or maintain healthy forest conditions. It provides a foundation to work collaboratively with at-risk communities to reduce wildfire hazards caused by fuel loads within the wildland urban intermix (WUI) that exceed desired conditions as defined by the Forest Plan (16 USC 6612 Sec.102 (b)). The Act requires federal agencies to consider recommendations made by at-risk communities that have developed community wildfire protection plans (16 USC Sec. 101 (3)). An updated list of urban wildland interface communities within the vicinity of federal lands that are at high risk from wildfire was published in the *Federal Register* on August 17, 2001. The community of South Lake Tahoe is listed in the Federal Register as a community at-risk. The South Lake Tahoe Fire Department, Lake Valley Fire Protection District, Tahoe Douglas Fire Protection District, and Fallen Leaf Fire Department have developed Community Wildfire Protection Plans (CWPPs).

Coordination and collaboration with CWPPs are an important parts of the HFRA analysis for this project. The community fire safe councils worked with corresponding fire departments and fire protection district personnel to design these CWPPs for effective defensible space across all land ownerships, including National Forest System lands. The LTBMU collaborates with the fire districts and fire safe councils to design fuel reduction activities that coordinate with the CWPPs and provide the defensible space identified in the CWPPs where it occurs on National Forest System land.

The LTBMU, State, and local agencies have reduced fuel hazards on approximately 13,000 acres from 2000-2006. In 2007, Tahoe Regional Planning Agency (TRPA) published their Fuel Reduction and Forest Restoration Plan for the Lake Tahoe Basin WUI. This report synthesizes the CWPPs for the seven fire protection districts (FPD) to identify Basin-wide fuel reduction needs and the resources needed to implement a Basin-wide hazardous fuels reduction Plan. The TRPA report states “Although 13,000 acres have been treated in the Lake Tahoe Basin since 2000, increased efforts are needed to protect values at risk and restore forest health” (Fuel Reduction and Forest Restoration Plan for the Lake Tahoe Basin WUI, Executive Summary, pg. E-4, TRPA, 2007)

Existing Situation

A major public concern in the Lake Tahoe Basin is the threat of catastrophic fire. The cessation of Native American burning practices and over 50 years of fire suppression in the Basin have resulted in dense forests susceptible to fires that would burn severely and result in a high incidence of tree mortality. The combination of large amounts of hazardous fuels and the Tahoe Basin having one of the highest ignition rates in the Sierra Nevada, particularly in urban areas, contributes to the risk of a devastating wildfire (Murphy & Knopp 2000, pg. 435). The LTBMU Stewardship and Fireshed Assessment used basin-wide fire modeling to evaluate the likely effects of unplanned fires on urban areas and found that the most severe fires, and therefore effects, would occur in lower elevation pine and mixed conifer forests (Ten-year Integrated Vegetation and Fuels Management Program of Work, USDA Forest Service, 2007, unpublished). Crown fires are not easily controlled and could result in potential loss of life, loss of private property, significant impacts on natural resources, including lake clarity, and adverse effects to recreational opportunities and tourism (TRPA 2007, Executive Summary, pg. E-1). The wildfire behavior predicted by the Fireshed Assessment, the Lake Tahoe Watershed Assessment, the TRPA Fuel Reduction and Forest Restoration Plan, and the South Shore Landscape Analysis were verified by the intensity and severity of the 2007 Angora Fire.

The South Shore project area provides a diversity of recreation opportunities to the public, in both private and National Forest settings. The LTBMU has the fourth highest level of recreation visitor use of National Forests in Region 5 (USDA FS LTBMU 2002). The 2002 National Visitor Use Monitoring report ranked National Forests by visitation numbers. The LTBMU ranked as the National Forest with the 18th highest visitation. When LTBMU staff compared the acres within each of these top 18 most visited Forests nationwide, they found that the LTBMU has one of the highest densities of visitor recreation per acre in the National Forest system.

Within the South Shore project area are the communities of South Lake Tahoe, Meyers, Tahoe Paradise, and Christmas Valley, historic site attractions, resorts, and developed recreation facilities. Providing high quality recreation facilities and access to recreation opportunities on National Forest lands is an important management activity for the LTBMU. Dispersed recreation, including hiking and walking was identified as the most recorded primary activity on the LTBMU during the 2000-2001 National Visitor Use Monitoring survey (USDA FS LTBMU, pg. 13, 2002). The juxtaposition of high recreation use and high levels of hazardous fuels presents risk from wildfire to both the recreation experience and to the forest resources from recreation uses. Due to the existing high levels of hazardous fuels, there is a greater risk of catastrophic results from fire uses connected to recreation as well as a greater risk of recreation visitor entrapment in case of wildfire. The 2007 Angora Fire was started by an illegal campfire.

The scenic resources of the South Shore project area are highly valued by the Forest's visitors and residents. National visitor use monitoring surveys have identified that "viewing of National Forest lands" is the fourth most frequently recorded primary visitor activity on the LTBMU following hiking, skiing, and relaxing. Scenic quality plays an intrinsic role in visitors' experiences and helps to define what "Tahoe" means to people. Fuel reduction activities would provide long-term benefits to scenery by removing dead vegetation and ladder fuels that currently impede attractive views of Lake Tahoe, aspen stands, meadows, and the forest. Fuel reduction activities would also provide for a reduction in wildfire severity, leading to increased survival rates for larger trees and more rapid recovery of scenic quality in the event of wildfire.

Land ownership patterns in the Basin present a challenge to project implementation. Ninety-two (92) percent of the CWPP projects identify fuels treatment needs across multiple ownerships (federal, state, local, and private). Approximately 65 percent of the CWPP treatments include National Forest lands. A successful fuels reduction program will require effective coordination among land management and regulatory agencies.

Purpose and Need for Action

1. There is a need for defensible space adjacent to communities in the South Shore area where fire suppression operations can be safely and effectively conducted in order to protect homes and communities from wildfires. (Citygate Associates 2004); Community Wildfire Protection Plan for Lake Valley Fire Protection District, 2004; Community Wildfire Protection Plan for Fallen Leaf Fire Department, 2004, Community Wildfire Protection Plan for Tahoe-Douglas Fire Protection District, 2004; Murphy and Knopp, eds. 2000; South Shore Watershed Assessment, USDA FS, 2004; TRPA 2007; Lake Tahoe Basin Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy 2007).

2. There is a need for restoration of forest health in the South Shore area where stands of trees have become sufficiently dense and surface fuels have accumulated to such a degree that wildfires with sustained crown fire and long range spotting could quickly develop, causing severe resource damage and threatening human life and property. In addition, forest stands that are overly dense often suffer stress from drought and competition for nutrients, which subjects them to widespread forest dieback from insects and diseases (Murphy and Knopp, eds. 2000; South Shore Watershed Assessment, USDA FS 2004; TRPA 2007; Lake Tahoe Basin Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy 2007).

3. There is a need for restoration of meadows and aspen stands in the South Shore area in order to reduce the potential for catastrophic wildfire to spread through these areas, to promote maintenance of meadows and aspen stands consistent with the TRPA and Pacific Southwest Research Station "Aspen Community Mapping and Condition Assessment Report" (USDA FS, PSW-GTR-185), and to provide wildlife habitat for species that are dependent on meadows and/or aspen.

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

- Meet wildlife habitat condition requirements for sensitive species of native (and desired non-native, for example rainbow trout) plants and animals, consistent with the Forest Plan and TRPA goshawk disturbance zones.
- Achieve management direction in the LTBMU Management Plan as amended by the Sierra Nevada Forest Plan Amendment that the "desired condition" is for forests that "are fairly open and dominated primarily by larger, fire tolerant trees" within the WUI defense zone , (USDA FS 2004 , (SNFPA) pg. 40).

- Assure that treatments in stream environment zones (SEZs) favor riparian species while providing for large woody debris recruitment and stream shading needs. (USDA FS 2004 (SNFPA) pg. 64).
- Meet Water Quality Standards in the *Water Quality Control Plan for the Lahontan Region* (State of CA 2005).
- Lessen the risk of adverse effects from wildfire to soil productivity and water quality.
- Meet scenic quality objectives and stabilize scenic resources over the long-term in concert with achieving the desired conditions of stands that “are fairly open and dominated primarily by larger, fire tolerant trees.”
- Meet air quality standards for the Lake Tahoe Basin.

Public Involvement

The proposed action was developed through coordination and collaboration with the Washoe Tribe of Nevada and California, the City of South Lake Tahoe Fire Department, Lake Valley Fire Protection District, Tahoe Douglas Fire Protection District, Fallen Leaf Fire Department, Lahontan Water Board, Tahoe Regional Planning Agency (TRPA), and the public during a series of meetings during February and March of 2007. The proposed action was mailed to interested and affected parties in July of 2007. Field trips to a series of 3 sites for an on-the-ground look at types of areas proposed to receive fuel treatments by the South Shore project were hosted by members of the interdisciplinary team on a Tuesday and a Saturday in August of 2007, along with an evening open house to provide the public an opportunity to ask questions and gather information about this project. A total of seven written comment letters were received.

This initial scoping and preliminary environmental analysis phase determined that there is uncertainty regarding the effects of this project on the human environment. Therefore the responsible official elected to prepare a joint environmental impact statement/environmental impact report (EIS/EIR) in accordance with NEPA and CEQA.

Scoping for the EIS/EIR was done in accordance with 40 Code of Federal Regulations (CFR) part 1501.7 – Scoping. The notice of intent to prepare an EIS was published in the *Federal Register* on January 16, 2008. The notice of public scoping meeting, notice of intent, and CEQA-required notice of preparation, notice of completion, site map, and a supplemental potential environmental effects and mitigations measures paper were mailed to the State clearinghouse, responsible agencies and interested persons. One letter was received in response to this scoping period. Two joint Lahontan Water Board and Forest Service scoping meetings were held.

There were no substantive changes to the proposed action initially scoped in July 2007. Scoping comments submitted previously on this project were retained and treated the same as those received subsequent to the publication of the notice of intent and notice of proposal.

Issues

The Forest Service separated the issues brought forward by the public into three groups: Significant Issues, Non-significant Issues, and Non-issues. 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 reviews (Sec. 1506.3)…” A list of all issues collected during scoping and their classification into one of the three categories described can be found in the project record.

Significant issues are points of disagreement, debate, or dispute about the proposed action based on undesirable effects identified through scoping and are used to formulate alternatives to the proposed action, prescribe mitigation, or monitoring measures. They may also be used for analyzing environmental effects. Non-significant issues are defined as those issues beyond the scope of the proposed action; irrelevant to the decision to be made; already decided by law, regulation, or policy; and/or conjectural in nature or not supported by scientific evidence. Non-issues are general comments or concerns received through scoping that are not related to the proposed action's effects, and, therefore, cannot be resolved through an alternative or mitigation. Although Non-significant Issues and Non-issues were not used to formulate alternatives nor prescribe mitigation or monitoring measures, they were reviewed by the IDT.

The following issues were determined to be potentially significant and within the scope of the project decision as described in 40 CFR 1502.2. Issues that were identified from the comments received during scoping on the proposed action are given below:

- There is uncertainty whether implementation of the proposed action would result in significant cumulative effects to watershed conditions. The key indicator of effects is:
    - The number of HUC 7 watersheds with ground disturbance from this project resulting in an equivalent roaded acreage (ERA) that will exceed the threshold of concern (TOC) for the watershed, indicating the potential for increased susceptibility to adverse cumulative effects.
- There is a concern that fuel reduction activities that reduce canopy closure would degrade California spotted owl nesting and foraging habitat and threaten viability of these species. Key indicators of effects are:
    - Acres within California spotted owl protected activity centers (PACs) with at least 60 percent canopy cover before and after implementation. As existing canopy cover within spotted owl PACs is often less than 60 percent, average canopy cover for each PAC before and after implementation will also be used as an indicator.
    - Acres within California spotted owl home range core areas (HRCAs) with at least 50 percent canopy cover before and after implementation. As existing canopy cover within spotted owl HRCAs is often less than 50 percent, average canopy cover for each HRCA before and after implementation will also be used as an indicator.
    - Acres of suitable spotted owl foraging and nesting habitat (California wildlife habitat relationship strata equivalent to a 4M or higher classification) within spotted owl PACs, HRCAs, home ranges, and the wildlife analysis area before and after fuel treatment activities.
- There is a concern that fuel reduction activities that reduce canopy closure would degrade northern goshawk nesting and foraging habitat. Key indicators of effects are:
    - Acres within northern goshawk PACs and TRPA disturbance zones with at least 60 percent canopy cover before and after implementation. As existing canopy cover within goshawk PACs is often less than 60 percent, average canopy cover for each PAC before and after implementation will also be used as an indicator.
    - Acres of suitable goshawk foraging and nesting habitat (California wildlife habitat relationship strata equivalent to a 4M or higher classification) within goshawk PACs, TRPA disturbance zones, post-fledging family areas, home ranges, and the wildlife analysis area before and after fuel treatment activities.

Alternatives Considered in Detail

The three alternatives developed, (1, 2, 3) consider a full range of reasonable management options, including the No Action and Proposed Action alternatives.

In **Alternative 1**, the No-Action alternative, no vegetative treatments would take place and ladder and surface fuel loads would continue to increase. The Forest and private property would continue to be at risk for high-intensity crown fire.

In **Alternative 2**, the Proposed Action alternative, The Forest Service proposes 10,670 acres of vegetative treatments to reduce hazardous fuels on a four-year schedule, with initial treatments on approximately 2,500 acres per year. Most of the South Shore project acres will require activities extending over a period of three to seven years to attain fuel reduction conditions that would remain within desired condition for a period of 15 to 20 years post treatment. Hazardous fuel reduction would occur in all three zones of the WUI: on Forest Service-owned urban lots are within the urban core of the WUI, on Forest Service lands within the ¼ mile WUI defense zone extending from the urban core, and within the 1¼ mile WUI threat zone extending from the defense zone. Most areas would require two connected treatments, the first to remove trees and the second to reduce surface fuels.

Providing healthy wildlife habitat and restoration of a forest structure with increased resistance to drought, disease, and insects are objectives that also reduce the hazardous fuels. The South Shore project includes objectives for tree spacing and basal area to increase forest health while retaining larger trees and emphasizing retention of Jeffrey/ponderosa and sugar pine species. Restoration and maintenance of meadows and aspen stands would be accomplished by removal of encroaching conifers, mainly lodgepole pine and white fir.

In **Alternative 3,** the modified Proposed Action, 10,112 acres of vegetative treatments to reduce hazardous fuels on a four to five-year schedule would occur. This alternative was developed to address the issues raised in public scoping concerning watershed and wildlife effects. This alternative also responds to the CEQA requirement for an action alternative that mitigates or reduces environmental effects to an extent in line with concerns for public health and safety. Alternative 3 reduces impacts while meeting the purpose and need to effectively reduce fire risk by reducing fuels in the WUI. In Alternative 3, the following features were incorporated to reduce effects:

- Field review determined the units and portions of units to change treatment methods from mechanical to hand thinning to reduce watershed impacts.
- Scheduling of units for fuel treatments was refined to provide recovery time for watershed effects and refuge areas for CA spotted owls and northern goshawks.
- Modeling fire behavior for wildlife protected activity centers (PACs) provided individual stands that would resist crown fire if fire moving into the stand were a surface fire. These stands were removed from treatment or changed to hand treatments. Surrounding stands remained in the schedule for fuel treatments.
- There is al reduction in mechanical treatment units, a reduction in whole-tree mechanical units, and increase in cut-to-length units, an increase in hand thinning units, and an overall reduction in total acres compared to Alternative 2

Monitoring Strategy

Monitoring is critical for evaluating the effectiveness of management decisions and the accuracy of analysis assumptions and conclusions. It is also important to develop a monitoring strategy that meets two essential criteria: (1) it is helpful in making effective management decisions in the future, and (2) it is feasible to implement. The purpose of project monitoring is to track the implementation of the design features found in Chapter 2 and the prescribed BMPs, and in some cases, to measure their short-term effectiveness at protecting resources. Chapter 4 describes the monitoring that is required specific to the South Shore project. A discussion of differences between alternatives is organized by resource area and described when there would be a change in required monitoring based on a difference between the action alternatives. Specific resource areas for which monitoring would occur are:

- Soil, Water and Riparian Resources Monitoring
- Aquatic Resources Monitoring
- Transportation Monitoring
- Sensitive Plant Monitoring
- Invasive Weed Monitoring

Types of Monitoring

Implementation monitoring consists of visual monitoring of project treatment areas, roads, stream crossings, landings, etc., to ensure that all management practices and design features are implemented, including those designed to prevent sediment delivery and protect water quality (e.g., erosion control measures, riparian buffers, waterbars, critical dips) are in place as prescribed.

Effectiveness monitoring consists of visual monitoring to evaluate the effectiveness of the prescribed design features and management practices at meeting their objectives. It includes evaluating the effectiveness of management practices designed to prevent sediment delivery and protect water quality (e.g., erosion control measures, riparian buffers, waterbars, critical dips).

Required Monitoring for Soil, Water, and Riparian Resources

Soil Moisture

Monitoring soil moisture would be used to determine when soil conditions are suitable for mechanical equipment operations, in order to avoid detrimental compaction.

SEZ Pile Burning

The design features (Chapter 2) for pile burning in SEZs under both action alternatives are new to the Lake Tahoe Basin, and their effectiveness at protecting soil and water quality in SEZs has not been quantified. For the first two years after piles are burned, monitoring would be used to determine whether the design criteria were successful in avoiding significant impacts to soil stability, soil productivity and riparian plant growth: Results from this monitoring would be used to either support the current design features, or to modify them to provide additional protection to SEZs.

BMP and Design Feature Implementation

Implementation monitoring would occur in each treatment unit, as well as other areas affected by the South Shore project such as access roads, staging areas, water supply areas, etc. This would include completing a checklist that contains BMPs and design features contained in the NEPA and contract documents that apply to soil and water quality protection.

BMP Evaluation Program

Best management practice evaluation program (BMPEP) protocols would be followed to provide qualitative information about whether BMPs are implemented as prescribed in the NEPA document (and subsequent contract and permit requirements and specifications) and that they are effective in protecting soil and water resources. The BMPEP monitoring fulfills forensic monitoring requirements.

Monitoring Based on Cumulative Watershed Effects (CWE) Analysis Results

Several triggers have been agreed to by the LTBMU and Lahontan Water Board staff for additional monitoring requirements based on the results of the CWE analysis (discussed in more detail in the CWE section of Chapter 3). These triggers include: 1) an increase in risk ratio (RR) of 20% or more in watersheds not over the threshold of concern (TOC), 2) an increase in RR of 5% or more in watersheds that are over the TOC, and 3) equivalent roaded acres (ERA) increasing above the TOC due to project activities.

The Camp Richardson Frontal HUC7 watershed was already over the TOC prior to applying project treatments due to urban development, and exhibits an increase in RR of more than 5% with both Alternatives 2 and 3. Therefore, the Camp Richardson Frontal watershed meets the criteria for the second trigger mentioned above, and additional monitoring would be required in this watershed under both Alternative 2 and 3. The additional monitoring would include extra BMPEP evaluations beyond those required to meet the regional targets in stands adjacent to streamside management zones and at stream crossings (Protocols T01 and E09, respectively).

For Alternative 2, two watersheds exhibited an increase in RR over the course of project implementation of more than 20% (Tallac Creek (25.7%) and Taylor Creek (25.2%)). These watersheds would require additional monitoring to ensure that watershed effects are avoided under Alternative 2. This would include more intensive project level BMPEP evaluations in these watersheds for the streamside management zones (T01) and stream crossings (E09).

Required Monitoring for Aquatic Resources

Stream Temperature and Shade

The objective of fuel treatments in SEZs (along or adjacent to perennial flowing tributaries) is to have no measurable increase in stream temperature as a by-product of conifer removal. Monitoring parameters would include: a) selection of a minimum of four SEZ treatments, b) installation of three temperature loggers at each unit, c) temperature monitoring locations above, within and below each selected unit and d) measurement of stream shade at each temperature monitoring location.

Required Monitoring for Transportation

The mechanism for monitoring and documenting the implementation of transportation design features and BMPs will be the implementation monitoring checklist.

Storm Water Pollution Prevention Program

The storm water pollution prevention program (SWPPP) practices and features would be incorporated into the specifications for road design on each road that is constructed or reconstructed as well as all stream crossings. It will be provided later as part of the roads package. Inspections or monitoring of the SWPPP practices would be done by Forest Service personnel or a qualified contractor.

Construction and Reconstruction

Inspect construction and reconstruction as it is occurring to insure that BMPs are implemented according to the site-specific requirements for individual roads.

Drainage

- Insure that drainage structures are installed per contract BMPs, and continue to monitor functioning of drainage structures after storm events producing one inch or more precipitation, during spring runoff, and at the end of each season of use.

- If the above monitoring indicates a need, maintain all drainage structures during the season of use and as needed to protect soil and water quality over the winter.

Over Snow Use

- Monitor that snow depth and compaction are adequate for operations without damage to soils, as per design features in Chapter 2 and BMPs.

- Implement BMPs to prepare roads for over-snow use and insure that snow removal does not damage road surfaces or drainage structures; inspect when snow removal occurs.

Maintenance

- Monitor maintenance needs as it relates to water, soil, and air, while protecting the road investment. Inspect roads during every operation period during active use for the project.

- Include all project roads in the BMPEP random pool for implementation and effectiveness evaluations.

- Monitor winter closures of roads used by the South Shore project to assure that closure devices are adequate and effective. Forest Service roads (system and temporary) have date certain closures, specific to the road. If tire tracks in mud or snow are present after the closure date, corrective action would be taken.

- Monitor maintenance needs for roads to be used by the South Shore project annually in the spring before operations begin. Needed maintenance would be accomplished before use for project activities.

Post Project

- Assure that all system roads return to their original use, adequate for the user groups intended in the ATM after project implementation and use of each road is completed.

- Assure that all non-system roads are decommissioned and blocked from unauthorized use after project implementation and use of each road is completed.

-Monitor a random sample of roads, landings, and skid trails used by the project to ensure prescribed stabilization measures remain effective at the completion of the project, through the BMPEP monitoring program.

Required Monitoring for Sensitive Plants

Sensitive plant surveys have been completed for the South Shore project treatment units. Monitoring would occur during project implementation to avoid impacts to sensitive plant and sensitive fungi locations.

Required Monitoring for Invasive Weeds

The LTBMU noxious weed coordinator would be notified prior to project implementation activities in order to ensure that existing noxious weed infestations are treated or flagged in accordance with the design criteria (Chapter 2).

Implementation of noxious weed prevention practices would be monitored in compliance with the state and SNFPA (2004) standards. Require washing equipment before entering the project area when: equipment is coming from outside the Lake Tahoe Basin; if the previous location is unknown; or the previous location is infested with weeds. Equipment would be inspected after washing to insure the absence of soil, seeds, or plant materials.

After the project is completed for each year of ongoing implementation, the LTBMU noxious weed coordinator would be notified of the treatments units for that year. Inventory of the high risk areas (e.g. roads and landings) after project implementation would enable actions to ensure additional weed species do not become established and ensure that known weeds do not spread. All noxious weed infestations within the project footprint would be monitored and treated post implementation for 3 years or until eradicated.

Manual methods would be utilized to control noxious weeds. Manual control methods include hand-pulling, weed wrench, cutting/lopping, digging, grubbing, hoeing, removal of flower heads or seed pods.

Comparison of Alternatives

This section provides a comparison of the alternatives, based on the proposed activities in each alternative, how each alternative meets the Purpose and Need, how the alternatives respond to the significant issues, and the effects of implementing each alternative as represented by several key resources.

Comparison Table

Alternative 1 (No-Action)	Risk of high intensity wildfire would continue to increase as fuel continues to accumulate. No treatments would occur to reduce surface or ladder fuel loads. Overly dense forest conditions would contribute to tree mortality and continue to reduce resistance to drought, insects, and disease. Forest conifer species composition would continue trending toward white fir and lodgepole pine, with continuing loss of Jeffery, Ponderosa and sugar pine. Conifer encroachment would continue in meadows and riparian areas. Aspen stands at high risk for loss are likely to be lost to continued conifer encroachment. Two stream crossings currently causing resource impacts would not be repaired or improved..
Alternative 2 (Proposed Action)	Risk of high intensity wildfire would be reduced by treating surface and ladder fuels on 10,671 acres. Thinning would reduce basal area to densities that would increase resistance to drought, insects, and disease. Preferential retention of Jeffery, Ponderosa, and sugar pines would improve species composition toward the pre-settlement estimates of 50% pine. Meadow and riparian vegetation would recover as conifer encroachment is reduced. Aspen stands at high risk of loss would recover as conifer encroachment is reduced or removed. Two stream crossings currently causing impacts to water and fish passage would be replaced and improved
Alternative 3 (Modification of the Proposed Action)	Risk of high intensity wildfire would be reduced by treating surface and ladder fuels on 10,112 acres. Other items in Alternative 2 would apply to Alternative 3, but on fewer acres. Watershed impacts would be less that Alternative 2. Fewer acres of wildlife PACs would be thinned than Alternative 2. Fewer miles of roads would be needed than in Alternative 2. Mechanical treatment acres would decrease, hand thinning would increase..

Elements of the Purpose and Need and Issues

This section provides a summary of how the alternatives respond to the purpose and need, and issues, discussed in Chapter 1 of the DEIS.

The key elements of the Purpose and Need are:

- There is a need for defensible space adjacent to communities in the South Shore area where fire suppression operations can be safely and effectively conducted in order to protect homes and communities from wildfires.
- There is a need for restoration of forest health in the South Shore area where stands of trees have become sufficiently dense and surface fuels have accumulated to such a degree that wildfires with sustained crown fire and long range spotting could quickly develop, causing severe resource damage and threatening human life and property. In addition, forest stands that are overly dense often suffer stress from drought and competition for nutrients, which subjects them to widespread forest dieback from insects and diseases.
- There is a need for restoration of meadows and aspen stands in the South Shore area in order to reduce the potential for catastrophic wildfire to spread through these areas, and to promote maintenance of meadows and aspen stands.

By maintaining the existing condition, Alternative 1, the no action Alternative, fails to provide defensible space adjacent to home, businesses or communities. Alternative 1 perpetuates the existing forest density and the likelihood for high-intensity sustained crown fires causing severe resource damage and threats to human life and property. Ongoing mortality from drought, as well as dieback from disease and insects would continue or increase from current levels. Meadows with conifer encroachment are likely to experience lowering water tables and shrink in size as conifer encroachment continues. Riparian areas with conifer encroachment are likely to continue to see loss of vigor in riparian vegetation, and aspen stands at high risk for loss are likely to die out from conifer competition.

Alternatives 2 and 3 both meet the key elements of the purpose and need. Both action alternatives would provide defensible space where fire suppression actions could be effective in protecting homes and communities from wildfire. Thinning overly dense stands would change fire behavior from a sustained high intensity crown fire to a surface fire in most areas. Thinning would reduce tree competition and improve forest health which would increase forest resistance to drought, insects, and disease. Removal of conifers from encroaching on meadows and riparian areas would maintain or improve riparian vegetation vigor and water tables. Aspen stands where conifer encroachment is removed would show increased vigor and regeneration. The main differences between the two action alternatives are the acres treated, the treatment methods, and the environmental consequences. Acres and methods are displayed in the table below; a discussion of the differences in environmental consequences for key resources follows.

Treatment Type	Alternative 2 Acres	Alternative 3 Acres	Difference Acres
Hand Thinning	4,942	5,962	1,020
Cut-To-Length	1,910	2,010	100
Whole Tree	3,818	2,140	-1,678
TOTAL	10,670	10,112	-532

Key Resource Areas

Direct, indirect, and cumulative effects were analyzed for each resource area potentially affected by the project. The following is a summary of the effects for these resource areas. The resource area effects displayed are ones raised by the public during scoping, or are resource area effects with key differences between alternatives. This summary is not meant to capture all of the effects analyses for different resources. The complete description of effects to resources resulting from implementation of each of the alternatives is provided in Chapter 3.

Fire and Fuels

The No Action alternative would be expected to result in increased surface and ladder fuel levels throughout the South Shore project area, and wildfire would be expected to result in sustained high-intensity crown fire in the majority of the area.

Both Alternative 2 and 3 would reduce surface and ladder fuel loads and change fire behavior to a surface fire in the majority of the project area. Alternatives 2 and 3 would combine with other fuel reduction efforts to provide a functional defense zone for homes and communities. Both action alternatives would reduce flame lengths to enable wildfire suppression efforts to be successful.

Thinning small and suppressed trees in the action alternatives would reduce the risk of loss for larger, more fire-resistant trees. The result would be more open forest conditions where fire could be allowed to play its ecological role.

Alternative 2 treats more acreage than Alternative 3, and therefore changes fire behavior on more acres. Alternative 3 would have a shorter effective time frame because it contains more hand-thinned acres that would not be effective for the same length of time as mechanical thinning.

Forest Vegetation

Alternative 1 makes no changes to either vegetation structure or composition. Stress-related mortality would be expected to continue from competition in over-crowded stands with low resistance to drought, insects, or disease. The current trend would continue for pine species to decrease with a corresponding increase in white fir and incense cedar with a lower tolerance for fire and drought. The decline of aspen and riparian shrub species caused by conifer encroachment would continue.

The action alternatives, 2 and 3, would reduce stand mortality by reducing stand density to sustainable levels. Increased spacing between trees would reduce competition for water and nutrients and help reduce the spread of insects and disease. Removal of the shade-tolerant fir and cedar, while retaining Jeffery, ponderosa, and sugar pines, would begin to restore the ecological species balance in the South Shore area. Removal of conifers encroaching into meadows would reverse the loss of meadow vegetation and maintain or enhance meadow water tables. Removal of conifers encroaching into riparian areas would encourage riparian vegetation growth and retention of water tables. Aspen stands currently at risk of loss from overtopping and competition from conifers would respond with new growth with removal of encroaching confers. Alternative 2 produces these effects on more acres than Alternative 3.

Soil Resources

The No Action alternative would produce no direct effects to soils, however, because fire risk is increased for Alternative 1, the risk for detrimentally burned soils is also increased.

Effects for soils from the action alternatives would differ both because of the amount of acres treated and the treatment methods. Alternative 2 operates on more acres, uses more whole-tree mechanical methods, more skid trails, and more roads than Alternative 3, which gives Alternative 2 a higher potential for soil compaction. Alternative 2 uses more landings with more large landing burn piles with the potential for compaction and detrimentally burned soils under these large burn piles. Alternative 3 reduces total acres, uses more cut-to-length mechanical methods which operate on a bed of slash which reduces soil compaction, and includes a greater proportion of hand-thinning methods which also reduce the potential for soil compaction. There are fewer large landing burn piles with Alternative 3, but more small hand burn piles. This also reduces the potential for detrimentally burned soil because although there are more piles to burn, the burn temperatures, duration of the burn, and penetration of heat into the ground are less with the smaller hand piles. Alternative 3 has a lower potential for negative effects to soils than Alternative 2

Water and Riparian Resources

The No Action alternative would produce no direct effects to water quality, however, because fire risk is increased for Alternative 1, the risk for negative effects to watersheds and water quality is also increased. Modeling of watershed effects from wildfire projected wildfire effects to be greater than either action alternative by a factor of 3 to a factor of 5 depending on wildfire severity.

Similar to soils resources, effects for water and riparian resources from the action alternatives differ both because of differences in the amount of acres treated and the treatment methods. Alternative 2 operates on more total acres, and more acres within streamside environment zones (SEZs) using mechanical equipment than Alternative 3. Additional roads would be needed, and together with skid trails and landings, the disturbance levels in Alternative 2 would increase the risk ratio (RR) to a larger degree on more watersheds than Alternative 3. Although neither watershed would be pushed over 100% of their threshold of concern (TOC), Alternative 2 would increase the RR more than 20% for both Tallac and Taylor Creek watersheds. Alternative 3 has a decrease in mechanical treatment acres and an increase in hand thinning acres, especially in SEZs, which reduces ground disturbance levels close to streams and lakes. . Alternative 3 also requires fewer roads, landings, and skid trails, resulting in less ground disturbance. The changes for Alternative 3 reduce the increase in TOC for both Taylor and Tallac Creek watersheds to below 20%. The Camp Richardson Frontal watershed is currently over 100% TOC due to urban development, and both action alternatives increase the TOC more than 5% in order to effectively reduce fuels in this watershed. Public comments on the watershed effects of the Proposed Action were a major factor in developing Alternative 3, along with public comments on wildlife effects.

Aquatic Wildlife

The No Action alternative would produce no direct effects to aquatic wildlife. However, because fire risk is increased for Alternative 1, the risk for negative effects to aquatic wildlife habitat from ash and sediment, as well as direct fish kill, is also increased. There is also a greater risk for loss of vegetation to provide stream shade, and may result in increased water temperatures that may be beyond the tolerance of aquatic species.

Both Alternative 2 and 3 would reduce conifer density in SEZs adjacent to aquatic habitats which would reduce stream shading. Neither alternative is expected to result in an increase in the temperature regime of streams. Both alternatives would reduce conifer encroachment and encourage riparian shrub growth to enhance aquatic habitat quality. Alternative 3 affords greater protection for aquatic habitats with an increase in hand treatments in SEZs and a wider buffer for lake shores. Lahontan cutthroat trout (LCT), a Threatened species, are known to occur in the Upper Truckee River above Christmas Valley at the upper limit of the South Shore project area. This adjacent Lahontan cutthroat trout population could be affected by the project if individual LCT migrate into the project area before implementation occurs. By decreasing the amount of combustible fuels within Upper Truckee River RCAs/SEZs the potential for future effects on LCT resulting from wildfire would decrease.

Terrestrial Wildlife

The No Action alternative would produce no direct effects to terrestrial wildlife. However, because fire risk is increased for Alternative 1, the risk for destruction of terrestrial wildlife habitat from high-intensity sustained crown fire is also increased.

Public comments on wildlife effects of the Proposed Action were another factor in developing Alternative 3, along with comments about watershed effects. Alternative 2 would reduce fuels in wildlife areas, including PACs, where surface and ladder fuels exceed the desired conditions for the WUI. Under either action alternative scheduling would provide refuge areas during activities. In the development of Alternative 3, individual stands within PACs were modeled for fire behavior, and those stands that modeled as a surface fire were dropped from treatment. Stands that fire behavior modeling indicated would be of any crown fire type, were retained in the units for fuel reduction. The result is that Alternative 2 would have slightly less risk of crown fire, but more reduction in the quality of wildlife habitat, while Alternative 3 would have a slightly increased risk for crown fire over the landscape, but would maintain more high quality wildlife habitat, especially nesting habitat for CA spotted owls and northern goshawks. Neither action alternative would lead toward a trend toward listing for any terrestrial wildlife candidate or Forest Service sensitive species. Other species and details are found in Chapter 3.

TRPA Special Interest Species

The No Action alternative would produce no direct effects to TRPA special interest species. However, because fire risk would increase for Alternative 1, the risk for habitat loss from high-intensity wildfire would also increase.

Both action alternatives would improve habitats for TRPA special interest species, both by reducing surface and ladder fuels, and by removal of conifer encroachment from meadows, riparian area, and aspen stands. Northern goshawk TRPA disturbance zones prescriptions would retain habitat components needed by goshawks while reducing surface and ladder fuels, and are considered above as a Forest Service sensitive species. Both Alternative 2 and 3 retain existing winter roost trees within bald eagle winter habitat and all existing nest, roost, and perch trees for osprey while removing surface and ladder fuels. Critical deer fawning habitats within meadows would be improved with meadow improvement for both action alternatives, while forest hiding cover would be reduced by the removal of ladder fuels. Removal of encroaching conifers adjacent to wetlands would maintain or enhance water tables for waterfowl as well as increase sight distance for avoiding predators. BMPs and design criteria would conserve lake and stream fish habitats in the project area. The potential for fine sediment reaching the lake is greater in Alternative 2 than Alternative 3 because Alternative 2 has more acres of mechanical treatment and uses more road miles. However, any increases in fine sediment would not be measurable under either of the action alternatives. See Aquatic Wildlife above for Lahontan cutthroat trout. Summer nesting habitat would not be affected for either the bald or golden eagle. Indirect impacts to peregrine falcons may include slight changes in patterns of habitat use by prey species, subtly changing peregrine foraging behavior, though overall prey abundance is not expected to be affected by any of the alternatives.

Management Indicator Species

Alternative 1 would produce no direct effects to any management indicator species or their habitats. However, because fire risk is increased for Alternative 1, the risk for loss of MIS habitats from sustained crown fire is also increased.

Effects for riverine, wet meadow and riparian habitats are covered above under water and riparian resources, vegetation, and aquatic wildlife.

There are effects to conifer habitats for MIS species not covered in other resource areas above. Because most treatments proposed under the action alternatives would focus on removal of understory, small diameter trees, and retention of larger trees within the stand, treatments are expected overall to result in an increase in the average tree diameter per stand, and a decrease in both understory tree cover and overall vertical vegetation structure. The net effect is to create a shift in habitats from early- and mid-seral habitats to open canopy late-seral habitats. Direct and indirect effects from Alternatives 2 and 3 to understory shrub canopy closure are primarily a short term reduction in total shrub cover due to one or several of the following: 1) physical disturbance of shrubs from equipment use during mechanical thinning operations, 2) removal of shrubs to create landings, 3) purposeful burning of shrubs during underburning treatments, or 4) incidental burning of shrubs during pile burning treatments. Shrub cover reduction resulting from vegetation treatments would be expected to recover within 3-10 years, with regrowth dependent on the dominant shrub species, treatment type, and site conditions. Due to vegetation treatments conversion of some early- and mid-seral coniferous forest to late-seral open and closed canopy coniferous forest would occur.

Vegetation management projects remove snags in green forests only when necessary to meet fuels reduction or safety objectives, and on average retain a minimum of 3-8 medium to large snags per acre, per Forest Plan guidelines and project design features. These levels of snag retention are within the range of average snag densities observed across the Sierra Nevada bioregion. Removal of snags > 30 inches dbh is limited in both action alternatives, and would have minimal effect on large snag densities in burned forest in the wildlife analysis area; since only hazard trees would be removed adjacent to established infrastructure (e.g., houses, roads/trails, etc). Because burned forests contain higher snag densities than green forests in the wildlife analysis area, the potential reduction in snag density within burned forest would be greater than the reduction in green forest.

Neither action alternative would cause a change in the existing trend for MIS habitats in the Sierra Nevada bioregion, nor would either action alternative modify the existing distribution for any associated MIS species.

Sensitive Plants

Alternative 1 would produce no direct effects to any sensitive plant species or their habitats. However, because fire risk is increased for Alternative 1, the risk for loss of sensitive plants or their habitats from high-intensity wildfire is also increased.

Both action alternatives would protect sensitive plant populations by avoiding flagged areas during all ground-disturbing activities. Sensitive plant habitat would be enhanced by protecting water tables through removing conifers encroaching on their habitats, especially wet meadow and fen habitats.

Noxious Weeds

Alternative 1 would produce no direct effects to any noxious or invasive plant species. However, because fire risk is increased for Alternative 1, the risk for spread of invasive plants and creation of new infestations of noxious/invasive plants from high-intensity wildfire is also increased.

Both action alternatives contain design features to prevent the introduction and/or spread of invasive plants by avoidance of weed-infested areas and washing equipment before it is allowed into a new area if it is coming into the Lake Tahoe Basin, is coming from a known weed-infested site, or if the originating location is unknown. There is no difference in these features between the action alternatives.

Air Quality

The No Action alternative would produce no direct effects to air quality in the Lake Tahoe Basin. However, because fire risk is increased for Alternative 1, the risk for negative impacts to air quality and human health from high-intensity wildfire is also increased.

For either action alternative, all prescribed burning would be coordinated with the state and local air quality agencies to ensure that atmospheric stability and mixing heights are advantageous for dispersion of emissions. El Dorado County Air District is the permitting agency for a required smoke management plan. The smoke management plan would prescribe weather conditions (mixing heights and transport winds) that would avoid smoke effects as much as possible, in the City of South Lake Tahoe and other communities in the South Shore projects area, and Desolation Wilderness, a Class 1 airshed.

Pile and prescribed burning under either action alternative affects air quality in ways similar to wildfires, however, prescribed burning offers many advantages over wildfire. The effects of prescribed fire can be manipulated to reduce adverse effects to air quality. Smoke mitigation techniques include consideration of atmospheric conditions, season of burn, fuel and duff moisture, diurnal wind shifts, appropriate ignition techniques and rapid mop-up. These procedures would be followed and identified in burn plans to prevent adverse air quality effects. . Short duration production of smoke and associated emissions would occur during pile and understory burning. In comparison to a wildfire, prescribed burning produces much less smoke

Fugitive dust could result from thinning operations such as skidding and hauling during dry seasons in either action alternative. Fugitive dust caused by construction and use of unpaved roads can produce PM10 in quantities great enough to impair the visual quality of the air. Dust that is generated by skidding, loading, and site preparation activities also contributes to fugitive dust. These effects are localized and would be mitigated by effective dust abatement methods through contractual requirements for standard road watering to mitigate much of the problem. .

Heritage and Cultural Resources

Alternative 1 would produce no direct effects to any cultural or heritage resource. However, because fire risk is increased for Alternative 1, the risk for loss or degradation of cultural resources from high-intensity wildfire is also increased.

Both action alternatives would protect heritage and cultural resources in both passive and active methods. Passive methods would be to flag avoid cultural or heritage sites. Active methods include hand thinning to reduce the risk of damage from high-intensity wildfire and removal of conifer encroachment in aspen stands to reduce competition for aspens with arborglyphs.

Scenic Resources

The No Action alternative would not produce direct effects to any scenic resource. However, because fire risk is increased for Alternative 1, the risk for loss or degradation of scenic views from high-intensity wildfire is also increased. Long term and indirect effects of the No Action alternative could result in a decrease in the presence of valued scenic attributes, and may result in failure to meet visual quality objectives (VQOs).

During vegetation treatment implementation in both action alternatives, mechanical equipment or hand crew activities would cause a visual impact that exceeds VQO standards, but these activities would occur within short time durations. Clearing for landing areas is also considered a short-term impact that would temporarily exceed compliance with the VQOs. These areas would comply with VQOs following restoration measures and one to three years of vegetative growth.

Burn piles would remain in the landscape for one to three years following their creation and would not comply with the VQO of Retention or Partial Retention until they were burned. While smoke associated with prescribed burning of hand treated piles would have an effect on air clarity, this effect is also limited in scope and of short duration.

An indirect effect of implementing either action alternative would be increased viewing distances through more open forest stands. Views that were previously blocked by dense vegetation may become visible following treatment activities. This is likely to result in positive visual effects, such as revealed views of Lake Tahoe or surrounding landforms, and in negative visual effects, such as exposed views of neighborhoods or community infrastructure.

Implementation of the either action alternative would have an indirect benefit to the scenic stability of the project analysis area. The reduced probability of landscape-scale tree mortality would increase the likelihood that the area would maintain compliance with Forest Plan VQOs. Additionally, the removal of conifers from aspen stands, meadows and riparian corridors would help perpetuate these scenic landscapes into the future. Any visual impacts to water clarity resulting from any sedimentation and erosion associated with treatment activities are anticipated to be short lived or non-evident.

Historically the landscape within the project area experienced more frequent surface fires which resulted in a more open forest character compared to current conditions. The effects of implementing the vegetation treatments in either action alternative would mimic these historic conditions and would be consistent with the Forest Plan VQOs of Retention and Partial Retention. Cumulative effects of implementing either action alternative would build on these previous treatments and result in change to the landscape of the WUI that would improve scenic stability over the next 10 to 25 years.

Recreation

The No Action alternative would result in no short term or direct effects to the recreation resources, access or quality of recreation experience within the project area. Existing patterns of recreation use would be expected to remain, and to increase in volume over time. The potential for establishment of user-created trails remains, as does the potential for wildfires being started by legal or illegal recreation campfires. However, because fire risk is increased for Alternative 1, the risk for loss of recreation site infrastructure and loss of recreation opportunities from high-intensity wildfire is also increased.

A short-term direct effect during project management activities for both action alternatives would be temporary forest closures implemented to protect the public from safety hazards associated with tree removal and operation of mechanical equipment. During fuels management activities trucks and other equipment will be utilizing public travel routes and have the potential to increase traffic congestion and negatively affect the driving experience of highway users. Since “driving for pleasure” is an identified recreation use within the project area, this user group, as well as those traveling to recreation destinations, could be affected. Landing or staging areas associated with mechanical treatment units that are located near residential roads, especially those roads that provide public access to general forest areas, will alter the visual landscape and the experience of those recreating in these areas during and following treatment.

No changes to the Recreation Opportunity Spectrum classification are anticipated as a result of implementing either Alternative 2 or Alternative 3. Effects from Alternative 3 would be slightly less due to fewer acres treated, fewer trucks needed, and fewer roads and landings used.

Transportation

Alternative 1 would maintain the existing condition of the transportation system.

There would be no new permanent road construction under either action alternative. Both action alternatives would replace and improve two stream crossings currently blocking water flow and fish passage. The majority of South Shore project effects would be short-term, and occur during the 5-8 years of project implementation. Road maintenance and reconstruction would create ground disturbance that would be additive to other ongoing activities from other projects on both federal and private ownerships. Initial activities to maintain or create road surfaces would increase the potential for sediment transport, while improvements to both existing road surfaces and existing stream crossings would reduce the potential for sediment transport. The net effect is likely to be neutral or positive over the long term, because the improvements to road surface and stream crossings would be permanent, and the decommissioning and stabilization of temporary roads would reduce the potential for ongoing effects from these roads. Because Alternative 2 would call for approximately four more miles of temporary road mileage than Alternative 3, road impacts and cumulative impacts would be less for Alternative 3.

Social and Economic

The No Action alternative would produce no direct costs or benefits. However, because fire risk is increased for Alternative 1, the risk for loss of existing economic values along with the risk for accumulating fire suppression costs from high-intensity wildfire is increased.

Alternative 2 present value cost was estimated to be $12,233,000. The present net value for Alternative 2 was estimated at $-3,334,000 and a benefit-cost ratio of 0.73, which indicates that the project costs would exceed the value of the commercial products. As this alternative produces revenues from thinning only, values generated from the sale of generally smaller trees would not cover the costs associated with tree removal and extensive slash cleanup from past tree mortality.

For Alternative 3, present value revenue was estimated to be $6,942,000. The present net value for Alternative 3 was estimated at $-8,674,000 and a benefit-cost ratio of 0.44, which indicates that project costs would exceed the value of the commercial timber. As this alternative also produces revenues from thinning only, values generated from the sale of generally smaller trees would not cover the costs associated with tree removal and extensive slash cleanup from past tree mortality. Alternative 3 would utilize more cut-to-length harvesting over whole tree harvesting than in Alternative 2. Cut-to-length harvesting systems are more expensive than whole tree systems and with less acres of mechanical harvesting stands in Alternative 3 than Alternative 2, the ratio of costs to revenues is higher in Alternative 3.

The cumulative effects of either action alternative would include the maintenance costs associated with the various treatments. Maintenance of treatments within the defense zone of the wildland urban interface is estimated to cost $13,956,000. These treatments would occur in twenty years where understory trees have regenerated causing live fuel build up in the form of fire ladders and would consist of thinning or understory burning. The projected cumulative impacts of this project when combined with other projects would be to further increase employment and contracts to accomplish this work.

Indirect effects of the action alternatives are additional public benefits such as local employment, income generated from the forest products industry, and energy from local cogeneration plants.

Alternative 2 would create an estimated 25 full time jobs for timber industry employment. Based on a medium income of $70,516 for El Dorado County residents (US Census 2000, adjusted to 2006), the total employee related income for Alternative 2 would be $1,762,900. Alternative 3 would create an estimated 21 full time jobs for direct and induced employment. The total employee related income for Alternative 3 would be $1,481,000.

Environmental Justice

Adverse environmental or human health conditions created by any of the alternatives would not affect any minority or low income neighborhood disproportionately. The activities proposed in all alternatives were based solely on the existing and desired condition of the vegetation, sensitivity of the environment, and practical treatment access in response to the purpose and need. In no case was the treatment prescription design based on the demographic makeup, occupancy, property value, income level or any other criteria reflecting the status of adjacent non-federal land.

Chapter 1

Purpose and Need for Action

Document Structure

The Forest Service has prepared this Draft Environmental Impact Statement /Environmental Impact Report (EIS/EIR) in compliance with the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA) and other relevant Federal and State laws and regulations. The Forest Service is the lead Agency under NEPA and the California Regional Water Quality Control Board, Lahontan Region (Lahontan Water Board) is acting as the lead Agency under CEQA. This Draft EIS/EIR discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives to the proposed action. The document is organized into the following chapters consistent with NEPA regulations.

- **Chapter 1. Purpose and Need for Action**
  This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the Forest Service proposal for achieving that purpose and need. This chapter also details how the Forest Service and Lahontan Water Board informed the public of the proposal and how the public responded.
- **Chapter 2. Alternatives, including the Proposed Action**
  This chapter provides detailed descriptions of the no-action and the two action alternatives the Forest Service considered for this project, including integrated design features/mitigation measures. Finally, this chapter provides a summary table of the environmental consequences associated with each alternative.
- **Chapter 3. Affected Environment and Environmental Consequences**
  This chapter describes the existing conditions within the project area and the environmental effects of implementing each alternative, including the no action alternative. This chapter is organized by resource area.
- **Maps**
  All maps referenced in the document are located in this section.
- **Chapter 4. Monitoring**
  This chapter describes the monitoring that will take place under the action alternatives.
- **Consultation and Coordination**
- **Acronyms and Glossary**
- **References Cited**
- **Appendices**
  The appendices provide additional information as needed to support the analyses presented in this EIS/EIR.
- **Index**
  The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the USFS, Lake Tahoe Basin Management Unit, 35 College Drive, South Lake Tahoe, CA, 96150.

Background

The Healthy Forest Restoration Act of 2003 (HFRA) authorizes projects on federal lands to reduce fuel loads and increase or maintain healthy forest conditions. It provides a foundation to work collaboratively with at-risk communities to reduce wildfire hazards caused by fuel loads within the wildland urban intermix (WUI) that exceed desired conditions as defined by the Forest Plan (16 USC 6612 Sec.102 (b)). The Act requires federal agencies to consider recommendations made by at-risk communities that have developed community wildfire protection plans (16 USC Sec. 101 (3)). An updated list of urban wildland interface communities within the vicinity of federal lands that are at high risk from wildfire was published in the *Federal Register* on August 17, 2001. The community of South Lake Tahoe is listed in the *Federal Register* as a community at-risk. The South Lake Tahoe Fire Department, Lake Valley Fire Protection District, Tahoe Douglas Fire Protection District, and Fallen Leaf Fire Department have developed community wildfire protection plans (CWPPs).

Coordination and collaboration with CWPPs are an important parts of the HFRA analysis for this project. The community fire safe councils worked with corresponding fire departments and fire protection district personnel to design these CWPPs for effective defensible space across all land ownerships, including National Forest System lands. The USDA Forest Service Lake Tahoe Basin Management Unit (LTBMU) collaborates with the fire districts and fire safe councils to design fuel reduction activities that coordinate with the CWPPs and provide the defensible space identified in the CWPPs where it occurs on National Forest System lands.

The CWPPs for the Lake Tahoe Basin were completed in 2004 in response to public concern over hazardous fuel conditions. These CWPPs prioritize hazardous fuel reduction projects in and adjacent to their communities over a ten-year period. Regulatory agencies in the Basin, including the Tahoe Regional Planning Agency (TRPA), Lahontan Water Board, and California Department of Forestry and Fire Protection (CDF), have cooperatively modified regulations and ordinances to facilitate hazardous fuel removal projects.

HFRA authorizes environmental analysis under NEPA (16 USC 6514 Sec. 104 (a)) and establishes an “Objection” process to resolve differences of opinion before a decision is signed, rather than the standard appeal process for non-HFRA projects (16 USC 6515 Sec. 105). The environmental analysis leading to either a finding of no significant impact (FONSI) or preparation of an EIS follows standard NEPA process and findings requirements (16 USC 6514 Sec. 104). One purpose of HFRA is to promote collaboration that resolves issues and reduces both time and expense for preparation of environmental documentation in order to proceed with projects to reduce hazardous fuels and restore forest health in a shorter timeframe and with lower costs to the taxpayer (Healthy Forest Restoration Act of 2003).

The LTBMU, State, and local agencies have reduced fuel hazards on approximately 13,000 acres from 2000-2006. In 2007, TRPA published their Fuel Reduction and Forest Restoration Plan for the Lake Tahoe Basin Wildland Urban Interface (WUI). This report synthesizes the CWPPs for the seven fire protection districts (FPD) to identify Basin-wide fuel reduction needs and the resources needed to implement a Basin-wide hazardous fuels reduction Plan. The TRPA report states “Although 13,000 acres have been treated in the Lake Tahoe Basin since 2000, increased efforts are needed to protect values at risk and restore forest health” (TRPA 2007, Executive Summary pg. E-4).

In addition to the 2007 TRPA report, several other studies identify the need to reduce hazardous fuel loads in the Lake Tahoe Basin. The Lake Tahoe Watershed Assessment (Murphy & Knopp, editors 2000) found that current tree density is approximately four times that of 150 years ago and that there has been a pronounced shift away from pine and towards fir in younger trees. The proportion of less fire-resistant white fir and incense cedar has doubled over the past 200 years, while the component of more fire-resistant Jeffrey pine has declined by half. Watershed Assessment findings were that there have been few fires in the 20th century mostly due to excellent fire detection and suppression, with response time to human-caused fire is among the shortest in the Sierra Nevada. It was also noted that the Tahoe Basin has one of the highest fire ignition rates in the Sierra Nevada, concentrated around the urban interface. The watershed assessment projected that “should a fire escape initial control attempts under extreme wildfire conditions, at least 50 percent of the area in the resulting burn would likely be crown fire, with overstory tree mortality greater than 50 percent…. Even a small wildfire in the basin is potentially a significant event because of the juxtaposition of high ignition potential, high density and value of human developments, and high fuel hazard” (Murphy & Knopp, editors 2000, pg. 15). The recommendation from this assessment was “A combination of increased fire prevention, education, and strategic fuel hazard reduction will be most effective at reducing the likelihood of damaging fire in the basin” (Murphy & Knopp, editors 2000, pg. 15).

In 2004, the LTBMU prepared the South Shore Landscape Analysis (USDA FS LTBMU 2004), which also identified a need for cost-effective vegetation treatments to reduce hazardous fuel loads, particularly in the WUI. Recommended outcomes are to achieve conditions that (1) reduce the size and severity of wildland fires, and (2) result in stand densities necessary for healthy forests during drought conditions. This landscape analysis warns, “The consequences of doing nothing will result in continued high vegetation densities and species composition that is out of balance…. This would lead to increases in surface, ladder, and crown fuels…with increased potential for insect infestation, disease outbreaks, and uncharacteristically severe wildfires” (USDA FS LTBMU 2004, pg. 5-43).

A major public concern in the Lake Tahoe Basin is the threat of catastrophic fire. The cessation of Native American burning practices and over 50 years of fire suppression in the Basin have resulted in dense forests susceptible to fires that would burn severely and result in a high incidence of tree mortality. The combination of large amounts of hazardous fuels and the Tahoe Basin having one of the highest ignition rates in the Sierra Nevada, particularly in urban areas, contributes to the risk of a devastating wildfire (Murphy & Knopp, editors 2000, pg. 435). The LTBMU Stewardship and Fireshed Assessment used basin-wide fire modeling to evaluate the likely effects of unplanned fires on urban areas and found that the most severe fires, and therefore effects, would occur in lower elevation pine and mixed conifer forests (Ten-year Integrated Vegetation and Fuels Management Program of Work, USDA FS, 2007, unpublished). Crown fires are not easily controlled and could result in potential loss of life, loss of private property, significant impacts on natural resources, including lake clarity, and adverse effects to recreational opportunities and tourism (TRPA 2007, Executive Summary, pg. E-1). The wildfire behavior predicted by the Fireshed Assessment, the Lake Tahoe Watershed Assessment, the TRPA Fuel Reduction and Forest Restoration Plan, and the South Shore Landscape Analysis were verified by the intensity and severity of the 2007 Angora Fire.

The South Shore Fuel Reduction and Healthy Forest Restoration Project (known hereafter as South Shore project) area provides a diversity of recreation opportunities to the public, in both private and National Forest settings. The LTBMU has the fourth highest level of recreation visitor use of National Forests in Region 5 (USDA FS LTBMU 2002). The 2002 National Visitor Use Monitoring report ranked National Forests by visitation numbers. The LTBMU ranked as the National Forest with the 18th highest visitation. When LTBMU staff compared the acres within each of these top 18 most visited Forests nationwide, they found that the LTBMU has one of the highest densities of visitor recreation per acre in the entire National Forest system.

Within the South Shore project area are the communities of South Lake Tahoe, Meyers, Tahoe Paradise, and Christmas Valley, historic site attractions, resorts, and developed recreation facilities. Providing high quality recreation facilities and access to recreation opportunities on National Forest lands is an important management activity for the LTBMU. Dispersed recreation, including hiking and walking was identified as the most recorded primary activity on the LTBMU during the 2000-2001 National Visitor Use Monitoring survey (USDA FS LTBMU, pg. 13, 2002). The juxtaposition of high recreation use and high levels of hazardous fuels presents risk from wildfire to both the recreation experience and to the forest resources from recreation uses. Due to the existing high levels of hazardous fuels, there is a greater risk of catastrophic results from fire uses connected to recreation as well as a greater risk of recreation visitor entrapment in case of wildfire. The 2007 Angora Fire was started by an illegal campfire.

The scenic resources of the South Shore project area are highly valued by the Forest's visitors and residents. National Visitor Use Monitoring surveys have identified that "viewing of National Forest lands" is the fourth most frequently recorded primary visitor activity on the LTBMU following hiking, skiing, and relaxing. Of these three primary visitor activities, scenic quality plays an intrinsic role in visitors' experiences and helps to define what "Tahoe" means to people. Fuel reduction activities would provide long-term benefits to scenery, both by removing dead vegetation and ladder fuels that currently impede attractive views of Lake Tahoe, aspen stands, meadows, and the forest. Fuel reduction activities would also provide for a reduction in wildfire severity, leading to increased survival rates for larger trees and more rapid recovery of scenic quality in the event of wildfire.

Land ownership patterns in the Basin present a challenge to project implementation. Ninety-two percent of the CWPP projects identify fuels treatment needs across multiple ownerships (federal, state, local, and private). Approximately 65 percent of the CWPP treatments include National Forest lands. A successful fuels reduction program will require effective coordination among land management and regulatory agencies.

A portion of the South Shore project area is within the 2007 Angora Fire area. The fire burned approximately 1800 acres of proposed South Shore project fuel treatment units at variable intensities, leaving some of the South Shore proposed units in a condition that requires fuel reduction treatments in order to attain WUI desired conditions as defined in the SNFPA. During the 2007 field season, the Angora Fire area was evaluated to determine the extent of acres that need to remain in the South Shore project. It was determined that approximately 300 acres within the fire area still need fuel reduction treatments to attain desired conditions.

The South Shore project initiation letter established an interdisciplinary team of Forest Service specialists to evaluate opportunities to move from the existing conditions toward the conditions desired both in the Forest Plan as amended and in the communities in the South Shore area. Local Fire Districts (Lake Valley Fire Protection District, Fallen Leaf Fire Department, Tahoe Douglas Fire Protection District, and South Lake Tahoe Fire Department), TRPA, Lahontan Water Board, the Washoe Tribe of Nevada and California, and the public provided input for project design to the Forest Service both during meetings and in writing that was incorporated into the project design. The Proposed Action Alternative in this document is the product of that effort in collaboration with local Fire Districts, the Washoe Tribe of Nevada and California, TRPA, Lahontan Water Board, and the public.

Purpose and Need for Action

The following needs have been identified in this project area:

1. There is a need for defensible space adjacent to communities in the South Shore area where fire suppression operations can be safely and effectively conducted in order to protect homes and communities from wildfires. (Citygate Associates 2004); Community Wildfire Protection Plan for Lake Valley Fire Protection District, 2004; Community Wildfire Protection Plan for Fallen Leaf Fire Department, 2004, Community Wildfire Protection Plan for Tahoe-Douglas Fire Protection District, 2004; Murphy and Knopp, eds. 2000; South Shore Watershed Assessment, USDA FS, 2004; TRPA 2007; Lake Tahoe Basin Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy 2007).

2. There is a need for restoration of forest health in the South Shore area where stands of trees have become sufficiently dense and surface fuels have accumulated to such a degree that wildfires with sustained crown fire and long range spotting could quickly develop, causing severe resource damage and threatening human life and property. In addition, forest stands that are overly dense often suffer stress from drought and competition for nutrients, which subjects them to widespread forest dieback from insects and diseases (Murphy and Knopp, eds. 2000; South Shore Watershed Assessment, USDA FS 2004; TRPA 2007; Lake Tahoe Basin Multi-Jurisdictional Fuels Reduction and Wildfire Prevention Strategy 2007).

3. There is a need for restoration of meadows and aspen stands in the South Shore area in order to reduce the potential for catastrophic wildfire to spread through these areas, to promote maintenance of meadows and aspen stands consistent with the TRPA and Pacific Southwest Research Station "Aspen Community Mapping and Condition Assessment Report" (USDA FS, PSW-GTR-185), and to provide wildlife habitat for species that are dependent on meadows and/or aspen.

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

- Meet wildlife habitat condition requirements for sensitive species of native (and desired non-native, for example rainbow trout) plants and animals, consistent with the Forest Plan and TRPA goshawk disturbance zones.
- Achieve management direction in the LTBMU Management Plan as amended by the Sierra Nevada Forest Plan Amendment that the "desired condition" is for forests that "are fairly open and dominated primarily by larger, fire tolerant trees" within the WUI defense zone , (USDA FS 2004 , (SNFPA) pg. 40).
- Assure that treatments in stream environment zones (SEZs) favor riparian species while providing for large woody debris recruitment and stream shading needs. (USDA FS 2004 (SNFPA) pg. 64).
- Meet Water Quality Standards in the *Water Quality Control Plan for the Lahontan Region* (State of CA 2005).
- Lessen the risk of adverse effects from wildfire to soil productivity and water quality.
- Meet scenic quality objectives and stabilize scenic resources over the long-term in concert with achieving the desired conditions of stands that "are fairly open and dominated primarily by larger, fire tolerant trees."
- Meet air quality standards for the Lake Tahoe Basin.

- Discourage post-treatment establishment of user-created motorized or non-motorized routes or trails.
- Address public safety during implementation of the project.

Proposed Action

The goal of fuel reduction and forest health projects, including the South Shore project, is to reduce fuel hazards and to restore ecosystem health through cost-effective vegetation treatments. The primary management objective in the WUI is a reduction of hazard fuels in order to change fire behavior resulting in lower fire severity and reduced rates of spread. While it is not possible to eliminate wildfire from the Sierra Nevada ecosystem, effective hazardous fuel reduction provides space for fire suppression efforts to reduce the risk to communities from catastrophic wildfire.

The Forest Service proposes vegetative treatments to reduce hazardous fuels on a four-year schedule, with initial treatments on approximately 2,500 acres per year. Most of the South Shore project acres will require activities extending over a period of three to seven years to attain fuel reduction conditions that would remain within desired condition for a period of 15 to 20 years post treatment. Hazardous fuel reduction would occur in all three zones of the WUI: on Forest Service-owned urban lots within the urban and suburban urban core of the WUI, on Forest Service lands within the ¼ mile WUI defense zone extending from the urban core, and within the 1-1/4 mile WUI threat zone extending from the defense zone. Most areas would require two connected treatments, the first to remove trees and the second to reduce surface fuels.

Providing healthy wildlife habitat and restoration of a forest structure with increased resistance to drought, disease, and insects are objectives that also reduce the hazardous fuels. The South Shore project includes objectives for tree spacing and basal area to increase forest health while retaining larger trees and emphasizing retention of Jeffrey/Ponderosa and sugar pine species. Restoration and maintenance of meadows and aspen stands would be accomplished by removal of encroaching conifers, mainly lodgepole pine and white fir.

A detailed description of the proposed action is provided as Alternative 2 in Chapter 2 of this EIS/EIR.

Decision Framework

The Forest Service is the lead Federal agency under NEPA, and the deciding official for the preparation of the EIS/EIR is Terri Marceron, Forest Supervisor, Lake Tahoe Basin Management Unit, 35 College Drive, South Lake Tahoe, CA 96150. The Lahontan Water Board is the Lead Agency under CEQA and will consider certification of the EIR/EIS for the purposes of CEQA. Harold Singer, Executive Officer, Lahontan Water Board, 2501 Lake Tahoe Boulevard, South Lake Tahoe, CA 96150 will sign a decision document following the Lahontan Water Board's consideration and decision at a public hearing.

Given the purpose and need, the deciding official reviews the proposed action and the alternatives, with 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. The Lahontan Water Board will consider whether the environmental document complies with CEQA, including sufficient analyses and evaluation of alternative actions and the environmental consequences, adequacy of mitigation measures, and a monitoring program. The Lahontan Water Board will also consider authorizing the project under an individual waiver of waste discharge requirements and granting exceptions to waste discharge prohibitions, allowing disturbance within SEZs. The Lahontan Water Board may impose additional monitoring as part of its authorization.

The area available to be considered for treatments is constrained by other ownerships and land allocation objectives. The decision would apply only to National Forest System lands within the LTBMU in the project area.

While implementation of the decision would reduce fuel loading in areas of the WUI, hazardous fuels would only be reduced up to private land boundaries, and would not eliminate the threat to structures within private lands. To reduce the fire hazard within private lands, the private landowners would need to assess fuel loads and treat their lands in tandem with the action proposed in the South Shore project. Private lands account for 10,094 acres of the project analysis area, including the community-at-risk of South Lake Tahoe.

Forest Plan Direction

The South Shore project analysis area extends from Cascade Lake on the northwest to the Heavenly Mountain Resort Special Use Permit boundary and the Nevada State line on the northeast, and from Lake Tahoe on the north to the LTBMU boundary on the south (Map 2). Table 1-1 lists the acres by ownership in the project analysis area.

Table 1-1. Ownership

Ownership	Acres
Total project, all ownerships	86,790
private ownership	8,088
water and other (State, County)	8,121
National Forest System lands	70,581

The proposed action and alternatives are guided by the LTBMU Land and Resource Management Plan (USDA FS LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS, SNFPA 2004) and other amendments. The LRMP subdivides the LTMBU into land allocations (management areas), and establishes desired conditions and associated management direction (standards and guidelines) for those management areas. The LRMP for the LTBMU designates management areas according to the presence of resource values, rather than discrete units of land. Due to the complexity of the resource values present on the LTBMU, management areas often overlap; for example, a California spotted owl protected activity center (PAC) management area may be located inside the WUI defense zone management area, and a riparian conservation area (RCA) management area may cross both the defense zone and the PAC, and finally, a streamside environment zone (SEZ) management area is usually located within the RCA.

The commonly used definition of the wildland urban intermix (also referred to as the wildland urban interface, both abbreviated as WUI) includes all ownerships where there is a juxtaposition of urban/suburban development and undeveloped wildland. The SNFPA definition of the WUI land allocation contains several sub-classifications. The urban core includes urban or suburban development, with the defense zone extending approximately ¼ mile from the urban core, and the threat zone extending approximately 1¼ miles beyond the defense zone (USDA FS, SNFPA 2004). The SNFPA also directed the Forest to review the WUI boundaries for topography and other features on the landscape and evaluate community infrastructure such as power transmission lines and essential egress routes for inclusion in the WUI.

The South Shore project proposes vegetative treatments only on National Forest System lands in the WUI. Map 5 illustrates the locations of the WUI and its zones, while Table 1-2 provides WUI zones by land ownership within the South Shore project analysis area.

Table 1-2. WUI ownership

WUI Zone	Total Acres All Ownerships	National Forest Acres	National Forest Acre Percentage
Total all WUI zones	47,338	28,886	68%
urban core	14,487	1,466	10%
defense zone	17,750	17,322	98%
threat zone	10,101	10,098	100%

Table 1-3 displays the acres of LRMP management areas within the South Shore project analysis area. Chapter 2 discloses the treatment that would occur on National Forest System lands in these management areas by alternative.

Table 1-3. Forest Plan management areas

National Forest Management Area Descriptions	Analysis Area Acres*
USFS Wildland Urban Intermix (WUI)* threat zone defense zone urban core	28,886 10,098 17,322 1,466
CA spotted owl protected activity centers (PACs)*	2,897
CA spotted owl home range core areas (HRCAs)*	8,197
goshawk PACs*	3,358
riparian conservation areas (RCAs)* (USFS Sierra Nevada Forest Plan Amendment buffers)*	31,725
critical aquatic refuge (CARs) * Hell Hole – mountain yellow-legged frog Upper Truckee River – Lahontan cutthroat trout	11,813 1,706 10,107
stream environment zones, (SEZ) by soil 1B percentage*	3,651
inventoried roadless areas* Dardanelles Freel Pyramid	32,159 13,932 14,881 3,346
wilderness	10,984
Grass Lake Research Natural Area	356

*Not additive, due to rounding errors and the fact that management areas overlap.

The South Shore analysis area contains nine California spotted owl protected activity centers (PACs), which include approximately 300 acres each of forest meeting their nesting habitat criteria around a nest location. California spotted owl PACs have corresponding home range core areas (HRCAs), 1,000 acres of a combination of nesting and foraging habitat, including one or more PACs. Within both the PACs and HRCAs are fuel accumulations that require treatments to reduce hazards within the WUI and be consistent with Sierra Nevada Forest Plan Amendment (USDA FS (SNFPA) 2004) direction. The SNFPA allows treatments in California spotted owl PACs and HRCAs where needed to insure the overall effectiveness of fuels treatments in the WUI.

Within the South Shore analysis area are 16 northern goshawk PACs, which include approximately 200 acres each of forest meeting their nesting habitat criteria around a nest location. Northern goshawk PACs have a corresponding TRPA disturbance zone of 500 acres containing the PAC and additional foraging and fledging habitat. The northern goshawk PACs and TRPA disturbance zones also contain hazardous fuels that require treatments to reduce hazards within the WUI and be consistent with SNFPA direction. The SNFPA also allows treatments in northern goshawk PACs where needed to insure the overall effectiveness of fuels treatments in the WUI. Map 17 displays the owl and goshawk PACs.

In the South Shore project are also areas within SNFPA riparian conservation areas (RCAs) containing riparian vegetation types would require fuel reduction to meet riparian conservation objectives and be consistent with regulatory agency memorandum of understanding (MOU) requirements while reducing fuels.

This project proposes to reduce fuels on lands adjacent to and within RCAs (Map 14) and SEZs (Map 15). RCAs are a SNFPA-defined buffer for streams, dependent on the stream type (perennial, seasonal, ephemeral) rather than soil or vegetation in the RCA area. SEZs are located within the RCAs and are further defined by vegetation types, soil types, and hydrology. There are fewer acres of SEZs than of RCAs, due to the variability in riparian soils and vegetation, as is shown in Table 1-3 above.

Critical aquatic refuge areas (CARs) were established by the SNFPA decision for subwatersheds identified by the Forests containing 1) known locations of threatened, endangered, or sensitive species; 2) highly vulnerable populations of native plant or animal species, or 3) localized populations of rare native aquatic- or riparian-dependent plant or animal species. Riparian Conservation Objective #4 provides management direction to insure that management activities, including fuels reduction actions enhance or maintain physical and biologic characteristics associated with aquatic- and riparian-dependent species (USDA FS, SNFPA 2004, ROD, pg 33, 43-44). There are two CARs within the South Shore project analysis area (Map 16). The Hell Hole CAR does not contain any South Shore project treatment units. The Upper Truckee River CAR extends into the WUI, and contains some treatment units to reduce fuel loads in both action alternatives. See Chapter 2 for acreage by alternative, and Chapter 3 for disclosure of the effects of the fuel reduction treatments by alternative.

Within the project boundary there are 883 miles of streams, of which 85 miles provide seasonal and perennial stream habitat for fish (Map 14). The majority of fuel reduction would occur in ephemeral stream environments; however, treatments are also proposed to reduce fuels in SEZs of seasonal and perennial streams. Table 1-4 shows miles of stream by type, and miles of fish habitat in the South Shore project analysis area. Miles of stream type and fish habitats that would receive treatments are discussed by alternative in Chapter 2.

Table 1-4. Total Stream Types

Stream Type	Total Miles within Analysis Area
ephemeral streams	652
seasonal streams	23
perennial streams	208
fish habitat	85

Within the South Shore project analysis area are some land allocations that either restrict or do not allow fuel reduction activities. Desolation Wilderness is a land allocation that does not allow hazardous fuel treatments. Grass Lake natural research area is also not included for fuel treatment. inventoried roadless areas restrict the type of fuel treatments that may occur.

The South Shore project area contains portions of three inventoried roadless areas (Dardanelles, 13,932 acres; Freel, 14,881 acres; and Pyramid, 3,346 acres; for a total of 32,159 acres of inventoried roadless (Map 21) that were originally inventoried during the 1970's in the roadless area review and evaluation (RARE II) process. The 1984 California wilderness bill designated some RARE II areas as wilderness, added some RARE II lands to existing wilderness areas, and released the remaining RARE II areas from further review for inclusion in the national wilderness system. The 2001 Forest Service Roadless Rule provided direction to update the inventory of the original RARE II areas, and protect the roadless character of all areas identified in the RARE II inventory that remained roadless at that time. This updated inventory under the 2001 Roadless Rule divided the original RARE II areas into three categories of inventoried roadless areas (IRAs): 1A applied to lands that had been either designated as new wilderness areas or added to existing wilderness areas; 1B applies to lands that retain their roadless character; and 1C applies to lands that are currently roaded.

Because of mapping errors for the original roadless area boundaries, and minor amounts of road construction that occurred between 1984 and 2000, there are some roads that occur within the original RARE II boundaries that are now classified as 1C IRA lands, including portions of Highway 89.

Reduction of hazardous fuels is allowed under the 2001 Roadless Rule, but construction of new roads is not allowed. Treatments under this project would comply with the rule and use only existing roads in any IRA. South Shore project activities would occur only on a portion of the 1C lands, see Table 2-7 for details of acres by IRA category and treatment type by Alternative.

Public Involvement

The proposed action was developed through coordination and collaboration with the Washoe Tribe of Nevada and California, the City of South Lake Tahoe Fire Department, Lake Valley Fire Protection District, Tahoe Douglas Fire Protection District, Fallen Leaf Fire Department, Lahontan Water Board, Tahoe Regional Planning Agency (TRPA), and the public during a series of nine meetings during February and March of 2007. The proposed action was mailed to interested and affected parties in July of 2007. Field trips to a series of 3 sites for an on-the-ground look at types of areas proposed to receive fuel treatments by the South Shore project were hosted by members of the interdisciplinary team on a Tuesday and a Saturday in August of 2007, along with an evening open house to provide the public an opportunity to ask questions and gather information about this project. A total of seven written comment letters were received.

During this initial scoping and preliminary environmental analysis phase, it was determined that there is uncertainty regarding the effects of this project on the human environment. Therefore the responsible official elected to prepare a joint environmental impact statement/environmental impact report (EIS/EIR) in accordance with NEPA and CEQA. The Forest Service has sought, and will continue to seek, information, comments, and assistance from federal, state, and local agencies and other individuals or organizations interested in or affected by the South Shore project.

Scoping for the EIS/EIR was done in accordance with 40 Code of Federal Regulations (CFR) part 1501.7 – Scoping. The notice of intent to prepare an EIS was published in the *Federal Register* on January 16, 2008. The comment period on the proposed action extended 30 days from the date the notice of intent was published in the *Federal Register*.

The notice of public scoping meeting, notice of intent, and CEQA-required notice of preparation, notice of completion, site map, and supplemental potential environmental effects and mitigations measures paper were mailed to the State clearinghouse, responsible agencies and interested persons on January 14, 2008. The comment period for these documents extended 30 days from the date they were mailed. One letter was received in response to this scoping period.

Two joint Lahontan Water Board and Forest Service scoping meetings were held; one on January 23, 2008 from 10:00 am to noon in the Board Room at Lake Tahoe Community College, 1 College Dr, South Lake Tahoe, CA; and the second on February 14, 2008 from 1:00 to 3:00 pm at the Lahontan Water Quality Control Board office, 2501 Lake Tahoe Blvd, South Lake Tahoe, CA.

However, because there were no substantive changes to the proposed action initially scoped in July 2007; those who previously submitted comments on this project were not required to resubmit them. Scoping comments submitted previously on this project have been retained and treated the same as those received subsequent to the publication of the notice of intent and notice of proposal.

Issues

Comments from the public, other agencies, and the Washoe Tribe of Nevada and California provided information used to formulate issues concerning the proposed action. The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues are 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 40 CFR, part. 1500, "…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 to be non-significant may be found in the South Shore project record located at the LTBMU.

Issues that were identified from the comments received during scoping on the proposed action are given below:

- There is uncertainty whether implementation of the proposed action would result in significant cumulative effects to watershed conditions. The key indicator of effects is:
  - The number of HUC7 watersheds with ground disturbance from this project resulting in an equivalent roaded acreage (ERA) that will exceed the threshold of concern (TOC) for the watershed, indicating the potential for increased susceptibility to adverse cumulative effects.
- There is a concern that fuel reduction activities that reduce canopy closure would degrade California spotted owl nesting and foraging habitat and threaten viability of these species. Key indicators of effects are:
  - Acres within California spotted owl protected activity centers (PACs) with at least 60 percent canopy cover before and after implementation. As existing canopy cover within spotted owl PACs is often less than 60 percent, average canopy cover for each PAC before and after implementation will also be used as an indicator.
  - Acres within California spotted owl home range core areas (HRCAs) with at least 50 percent canopy cover before and after implementation. As existing canopy cover within spotted owl HRCAs is often less than 50 percent, average canopy cover for each HRCA before and after implementation will also be used as an indicator.
  - Acres of suitable spotted owl foraging and nesting habitat (California wildlife habitat relationship strata equivalent to a 4M or higher classification) within spotted owl PACs,

HRCAs, home ranges, and the wildlife analysis area before and after fuel treatment activities.

- There is a concern that fuel reduction activities that reduce canopy closure would degrade northern goshawk nesting and foraging habitat. Key indicators of effects are:
  - Acres within northern goshawk PACs and TRPA disturbance zones with at least 60 percent canopy cover before and after implementation. As existing canopy cover within goshawk PACs is often less than 60 percent, average canopy cover for each PAC before and after implementation will also be used as an indicator.
  - Acres of suitable goshawk foraging and nesting habitat (California wildlife habitat relationship strata equivalent to a 4M or higher classification) within goshawk PACs, TRPA disturbance zones, post-fledging family areas, home ranges, and the wildlife analysis area before and after fuel treatment activities.

Laws, Regulations, and Policies

All resource management activities described and proposed in this document would be implemented to the extent that they are consistent with applicable Federal law, United States Department of Agriculture (USDA) regulations, Forest Service policies, and applicable provisions of State law. The major laws and their applicability to the proposed action are as follows:

Clean Water Act (Public Law 92-500)

All Federal agencies must comply with the provisions of the Clean Water Act. The Clean Water Act regulates forest management activities near federal waters and riparian areas. The proposed action meets the terms of the Clean Water Act for non-point sources of pollution, primarily pollution caused by erosion and sedimentation.

Clean Air Act (Public Law 84-159)

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

The project area lies within the Lake Tahoe Air Basin and the El Dorado Air Quality Management District. As a matter of regional policy, a smoke management plan would be submitted to and approved by El Dorado Air Quality Management District, who would issue a Burn Permit to the LTBMU prior to any burning that would occur within the South Shore project area. Several communities lie within proximity of the areas where both pile and prescribed burning is proposed to occur. Adherence to the smoke management plan for pile and understory burning would reduce negative impacts to communities. By adhering to a smoke management plan approved by the Lake Tahoe Basin Management Unit Forest Supervisor and the El Dorado Air Quality Management District, particulate matter emissions from pile or understory burning would not violate California Ambient Air Quality (CAAQ) emission standards.

Dust abatement would be accomplished by applying water to roads, landings, and skid trails at a frequency that would control dust.

Environmental Justice (Executive Order 1289)

Executive Order 12898 requires that all federal actions consider potentially disproportionate effects on minority and low-income communities especially if adverse effects to environmental or human health conditions are identified. Adverse environmental or human health conditions created by any of the alternatives considered would not affect any minority or low income neighborhood disproportionately.

The activities proposed in all alternatives were based solely on the existing and desired condition of the vegetation, sensitivity of the environment, and practical treatment access in response to the Purpose and Need. In no case was the treatment prescription design based on the demographic makeup, occupancy, property value, income level or any other criteria reflecting the status of adjacent non-federal land. Federally owned lands proposed for treatment are distributed throughout the project area, and are intermixed with non-federal lands. Reviewing the location of the proposed treatments in any of the alternatives in relationship to non-federal land, there is no evidence to suggest that any minority or low income neighborhood will be affected disproportionately. Conversely there is no evidence that any individual, group or portion of the community will benefit unequally from any of the actions in the proposed alternatives.

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

Section VII of the Endangered Species Act requires Federal agencies to consult with the United States Department of the Interior Fish and Wildlife Service and/or the United States Department of Commerce National Marine Fisheries Service (NMFS), whichever is appropriate, during project planning when Threatened or Endangered species, or their associated critical habitat, may be affected by a project. Consultation was not required for the South Shore project because no Threatened or Endangered species, or their associated critical habitat, would be affected by this project.

Federal Insecticide, Fungicide, and Rodenticide Act; (7 U.S.C. 136 as amended)

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

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

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

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

The National Forest System lands affected by the South Shore project are subject to management direction in the 1988 LTBMU Land and Resource Management Plan (LRMP) as amended by the 2004 SNFPA ROD. The LRMP, as amended, guides management of all National Forest lands and resources within the South Shore project area. It includes direction for forest management, goals and objectives, area management direction, and standards and guidelines.

The LRMP, as amended, has been reviewed in consideration of the South Shore project. This project is responsive to guiding direction contained in the Plan, is consistent with the standards and guidelines contained in the Plan, and is consistent with the requirements for management prescriptions.

National Environmental Policy Act of 1969 [NEPA] (Public Law 91-190)

NEPA requires that Federal agencies complete detailed disclosure on proposed actions and alternatives to the proposed action that may significantly affect the quality of the human environment. The purpose of an environmental impact statement is twofold: 1) to provide decision makers with a detailed accounting of the likely environmental effects of a proposed action and any alternatives prior to adoption of an action, and 2) to inform the public and allow it to comment on those environmental effects. This EIS analyzes the alternatives and discloses their effects in detail. The procedural requirements of NEPA have been met.

National Historic Preservation Act (Public Law 89-665)

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

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

The proposed action is consistent with provisions of the Wild and Scenic Rivers Act, which regulates forest management activities within the National Wild and Scenic Rivers System. Specifically, these lands are to be administered in such a manner as to protect and enhance the values that caused them to be included in the system, without limiting other uses that do not substantially interfere with public use and enjoyment of these values. The primary emphasis is given to protecting these lands' aesthetic, scenic, historic, archaeological, and scientific features and to maintaining the free-flowing character of the system river. The Secretary of Agriculture may utilize the general statutory authorities relating to the National Forests to carry out the purposes of this Act.

There are no designated wild and scenic rivers within the South Shore project area.

California Environmental Quality Act [CEQA] (Public Resources Code, § 21080)

CEQA applies to discretionary projects to be carried out or approved by public agencies. The Lahontan Water Board's process to grant a conditional waiver of waste discharge requirements or waste discharge requirements for vegetation/timber harvest activities on National Forest lands is a discretionary act subject to CEQA. Prior to approving a project, the Lahontan Water Board must certify that: (1) the final EIR has been completed in compliance with CEQA; (2) that the Lahontan Water Board has reviewed and considered the information contained in the final EIR; and (3) that the final EIR reflects the Lahontan Water Board's independent judgment and analysis. (Cal. Code Regs., tit. 14, § 15090.)

The Lahontan Water Board must make findings for each significant effect identified in the EIR, and prepare a mitigation measure monitoring and reporting plan. Mitigation measures will be incorporated into the terms of the conditional waiver of waste discharge requirements or waste discharge requirements issued as a result of the project. Once the final EIR is certified, the Lahontan Water Board will make the final decision concerning which project alternative to select for implementation. At that time, and after consideration of the final EIR, the Lahontan Water Board may not approve a project unless it will not have a significant effect on the environment, or that mitigation measures have eliminated or substantially lessened any significant effect on the environment. (Cal. Code Regs., tit, 14, § 15092.)

Permits and Coordination

The Forest Service coordinates its activities with Federal, County, and State of California regulatory agencies, including air quality management districts and water quality control boards. Permits would be required from the El Dorado Air Quality Management District prior to prescribed burning. Conditional waivers of the requirement to file a report of waste discharge or a Permit for Waste Discharge for vegetation/timber harvest activities on National Forest lands would be required from the Lahontan Water Board.

The Forest Service and Lahontan Water Board are actively consulting and coordinating with Federal, State, and local agencies, and tribes that have an interest in the project or could have a role in reviewing and/or providing permits or other approvals for aspects of the project.

Water Quality Control Plan for the Lahontan Region (Basin Plan)

The Lahontan Water Board prepared a Basin Plan that "is the basis for the regional board's regulatory program. It sets forth water quality standards for the surface and ground waters of the region, which include both designated beneficial uses of water and the narrative and numerical objectives, which must be maintained or attained to protect those used. It identifies general types of water quality problems, which can threaten beneficial uses in the region. It then identifies required or recommended control measures for these problems. In some cases, it prohibits certain types of discharges in particular areas. The Basin Plan summarizes applicable provisions of separate state board and regional board planning and policy documents (e.g., the regional board waiver policy), and of water quality management plans adopted by other federal, state, and regional agencies. The Basin Plan also summarizes past and present water quality monitoring activities which should be carried out to provide the basis for future Basin Plan updates and for waste discharge requirements or conditional waivers" (Lahontan Water Board 1994). MOUs exist between the Forest Service and Tahoe Region Planning Agency and the Forest Service and Lahontan Water Board to address water quality requirements.

The Basin Plan includes waste discharge prohibitions applicable within the Lake Tahoe Basin (Basin Plan section 5.2). ‘Waste’ includes, but is not limited to waste earthen materials (such as soil, silt, sand, clay, rock, or any other organic or mineral material) and any other waste as defined in the California Water Code section 13050(d). The Lahontan Water Board can grant exemptions to the prohibitions against discharges or threatened discharges attributable to new development or permanent disturbance in SEZs for erosion control projects, habitat restoration projects, wetland rehabilitation projects, SEZ restoration projects, and similar projects, programs, and facilities, if all of the following findings can be made:

(a) The project, program, or facility is necessary for environmental protection or public health and safety;

(b) There is no reasonable alternative, including relocation, which avoids or reduces the extent of encroachment in the SEZ; and

(c) Impacts are fully mitigated.

Chapter 2

Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the South Shore project. It describes both alternatives considered in detail and those eliminated from detailed study. At the end of this chapter the alternatives are presented in tabular format so that the alternatives and their environmental impacts can be readily compared.

Alternatives Considered in Detail

Based on the issues identified through public comment on the proposed action, the Forest Service developed a second action alternative proposal that achieves the purpose and need differently than the proposed action. In addition, the Forest Service is required to analyze a No Action alternative. The no action (Alternative 1), the proposed action (Alternative 2), the second action alternative (Alternative 3), and the alternatives considered but eliminated from detailed study are described in detail here in Chapter 2.

Alternative 1 – No Action

Under the No Action alternative, current management plans, especially the SNFPA decision to emphasize reduction of hazardous fuels in wildland urban intermix areas, would not be implemented. Current conditions would continue within the project area. Thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would not be implemented to accomplish the purpose and need in the project area.

Features Common to Both Action Alternatives (Alternatives 2 and 3)

Prescriptions for both action alternatives are designed with two objectives in mind: to achieve the purposes for the project, and to avoid or reduce adverse impacts while achieving those purposes. South Shore project prescriptions were designed to reduce hazards from existing fuels and modify fire behavior to provide the SNFPA defense zones for adjoining developed private lands. Vegetation treatments were also designed to improve riparian vegetation communities where applicable (aspen stands, meadows, etc.) through the removal of encroaching conifers.

Varying levels of stand treatment prescriptions are based on land allocations and their desired future conditions as specified in the Forest Plan, as amended by the SNFPA Record of Decision (ROD) (USDA FS 2004). See Table 1-3 for the land allocations within the project area.

Treatment prescriptions were also designed to be consistent with TRPA code of ordinances for vegetation and fuels management within streamside environment zones (SEZs), which are biological communities that owe their characteristics to the presence of surface water and/or a seasonally high groundwater table (State of CA Regional Water Quality Control Board 2005, chapter 71.4C). Treatment prescriptions include the following:

- All equipment shall be restricted from SEZs except for the following conditions:
    - existing roads;

- over-snow operations;
- end lining cable systems with no equipment in SEZ;
- "innovative technology" vehicles operating when soil conditions are dry enough so that the effects of these vehicles cause no greater soil or vegetation disturbance than over-snow tree removal;
- when needed for health and safety reasons.

- Work in SEZs would be limited to the time of year when soils are sufficiently dry or when snow conditions are at depth to avoid compaction, which would be determined by the soil scientist and/or hydrologist.
- Trees not needed for stream shading or in-stream coarse woody debris [that are to be removed to reduce fuels] would be directionally felled away from seasonal and perennial streams.

The action alternatives are also consistent with Forest Plan standards and guidelines for vegetation and fuels management within SEZs, including:

- Hand piling and burning of slash would be located beyond 50 feet of any stream channel or standing water.
- Prescribed underburning would use a backing fire designed to avoid adverse effect on soil and water resources. Flame heights would not exceed two feet within 50 feet of stream courses or on wetlands unless higher intensities are required to achieve specific objectives detailed in the burn plan. Backing fires are ignited outside of SEZs and allowed to creep into the SEZ; there is no ignition within the SEZ.

The interdisciplinary team created integrated alternatives for the South Shore project. Just as all of the resources together make up the complexity that is the South Shore project area, the design features work together over multiple resources. The design features for the alternatives are given by resource areas for ease of reading, although all of the design features connect to construct the alternatives.

Alternative 2 – The Proposed Action

The proposed action features an integrated design to benefit a variety of resources while reducing fuel loading to change exiting conditions in the project area towards meeting the desired conditions defined in the SNFPA for the wildland urban intermix.

Fuels and Vegetation Treatment Objectives

- Reduce hazards to residences and other resources at risk from wildland fire by creating defensible space around communities within the WUI on National Forest lands:
    - In the defense zone, including riparian conservation areas (RCAs), reduce dead and live fuel loads to change fire behavior and reduce wildfire hazard.
    - In the threat zone, use strategically placed area treatments (SPLATS) to reduce dead and live fuel loads in order to change fire behavior and reduce wildfire hazard. Activities could be located within RCAs in threat zones.
- Reduce existing stand density of approximately 160 to 350 ft^2 basal area by removing live understory trees to achieve a residual stand density of 100 to 150 ft^2 basal area per acre. Remove standing and down dead trees to achieve a residual surface fuel load of 5 to 15 tons per acre in treatment areas. The resulting conditions are expected to increase forest health and cause a fire to burn at lower intensities and slower rates of spread compared to untreated areas.

- Treat fuels in a manner that changes wildland fire type from a crown fire to a surface fire, thereby contributing to more effective fire suppression capabilities and fewer acres burned.
- Strategically place treatment areas within threat zones to interrupt potential fire spread, referred to by the SNFPA as SPLATs.
- Reduce the risk of effects to air quality from smoke generated by wildfire by reducing the available fuels and reducing the potential for active crown fire.
- Actively restore fire-adapted ecosystems by reducing unnaturally dense conditions to enable the use of prescribed fire to maintain desired conditions.
- Reduce encroaching conifers in aspen stands and meadows to restore riparian species dominance within these vegetation types.
- Follow SNFPA standards and guidelines (#'s: 10, 11, and 105) for vegetation treatments within aquatic, riparian, and meadow ecosystems.
- Use the LTBMU/Rocky Mountain Research Station General Technical Report-178 "Ecology, Biodiversity, Management, and Restoration of Aspen in the Sierra Nevada" (Shepperd et al. 2006) and findings of the Aspen community mapping and assessment project (located in LTBMU files) in developing site-specific vegetation treatment recommendations for aspen habitat within the proposed action area.
- Design activities to be consistent with LTBMU restoration plans for the Big Meadow Creek, Taylor/Tallac Creek, Cold Creek/High Meadow, and Upper Truckee River watersheds in developing vegetation treatment recommendations for these watersheds within the area proposed for treatment.
- Consider cost-efficiency in designing treatments to achieve timely implementation and maximize the number of acres that can be mechanically treated at lower costs under a limited budget. An example would be the use of whole-tree yarding methods instead of more expensive cut-to-length (CTL) methods where environmentally and operationally feasible.

Design features to meet fuels and vegetation treatment objectives

Prescriptions are designed to reduce hazards from existing fuels and modify fire behavior to provide SNFPA defense zones for adjoining developed private lands. Vegetation treatments are also designed to restore riparian vegetation communities where applicable (aspen stands, meadows, etc.) through the removal of encroaching conifers.

Options for prescriptions to achieve the purposes of the South Shore project include ground-based mechanical treatments when soil types, slope, and road access allow, including SEZ areas. Hand treatments, end-lining, or reaching in by equipment would be used where slopes or soil conditions are not suitable for mechanical treatments and where road access is not feasible.

A combination of the following methods could be used to meet the fuels and vegetation objectives for the South Shore project area, including SEZs:

- Mechanical thinning of brush and trees, using cut-to-length (CTL) or whole-tree operations.
- Hand thinning of brush and trees.
- Saw log and biomass removal, with chipping and/or masticating of slash and brush.
- Removing infested, diseased, and dead trees, both standing and down, that are in excess of wildlife and soils retention needs.
- Prescribed pile burning and underburning subsequent to vegetation treatments.

The thinning operations used would be based on soil type, slope, and associated water quality concerns such as delivery of sediments to surface water. Overall, mechanical harvesting using ground-based equipment with follow-up biomass removal, chipping, mastication, or prescribed burning, would occur on about 5,728 acres. Hand thinning with follow-up fuels treatments would occur on about 4,855 acres. Thinning method acres are compared by alternative later in this chapter (see Table 2-2).

Fuel treatments following thinning are not linked to the thinning method used; instead, fuel treatments are designed based on individual treatment unit requirements to meet fuels treatment objectives and desired conditions. Providing biomass would be preferred to burning whenever feasible, and could be supplied from a variety of the proposed treatments. Fuel treatment method acres are compared by alternative later in this chapter (see Table 2-3).

Live true fir and pine trees cut stumps 14 inches diameter and greater would be treated with an EPA registered borate compound (Sporax), which is registered in California for the prevention of annosus root disease.

- Sporax would not be applied within 25 feet of standing or running water.
- Sporax would not be applied in flag and avoid areas to protect threatened, endangered or sensitive plants.
- Sporax would not be applied during precipitation events.
- Sporax would be applied to conifer stumps within one hour of creation.

Example of an overly dense stand with fuel ladders

The following general prescriptions would apply to the defense and threat zones where protected activity centers (PACs), home range core areas (HRCAs), and other special wildlife areas are not located. In areas where special wildlife habitat is located, a modified prescription would be implemented as described in the Wildlife Habitat Design Features section of this document.

Mechanical Thinning - Uplands

The general prescription for ground-based mechanical treatments would be to remove primarily understory, and some overstory trees based on the desired residual stand density and expected wildfire behavior.

- Jeffrey/Ponderosa pine would be favored for retention. All sugar pines larger than 6" would be retained unless a tree shows obvious signs of white pine blister rust as evidenced by dead branches in the crown with swelling on the branch at the point of death.
- To achieve the desired conditions for fuel loads and stand densities live and dead trees removed would range between 3 to 30" diameters at breast height (dbh).
- Live tree density would be reduced through an understory thin where mostly suppressed and intermediate crown class trees, along with some co-dominant trees, would be removed to reduce competition and improve vigor and growth of residual trees, enabling them to better resist fire, insect attacks, and disease. Selection of trees to be thinned would begin with removal of the smallest trees (suppressed and intermediate trees) and continue to trees of increasing diameter until the desired fuel reduction and stocking level are reached. In some situations trees larger than 30" dbh might need to be removed for equipment operability.
- Snags and down logs would be removed as necessary to meet fuels objectives, beginning with the smallest diameter and retaining the largest snags and down logs present to meet Forest Plan wildlife and soils requirements.
- The type of mechanical equipment used for thinning operations would depend on vegetation removal needs, operational feasibility, and cost efficiency. They would include whole tree yarding using mechanical harvesters and whole tree skidding, and CTL harvest with log-forwarding operations. Treated material would be removed either as saw logs (whole tree or cut-to-length), fuelwood, or biomass.
- Mechanical treatments would be used to reduce upland hazardous fuels on slopes less than 30% and less sensitive soils.
- Hand treatments, end-lining or equipment reach would be used to reduce hazardous fuels on slopes greater than 30% (BMP #5-2).
- Treated material not removed would be processed on site through prescribed burning, chipping, or mastication. Masticated or chipped material would be spread over the treatment area, with a maximum depth of approximately 6" for chips.

Hand Thinning – Uplands

The general prescription for hand thinning treatments would be to remove primarily understory, and some overstory trees based on the desired residual stand density and expected wildfire behavior.

- For hand thinning treatments, live trees up to 14" dbh would be removed based on achieving the desired stand densities and fuel loads. In some stands, live trees up to 18" dbh could be removed in order to reduce densities enough to change current expected fire behavior from a crown fire to a surface fire.
- Dead trees removed would range between 1 to 20" dbh, and down logs would range between 3 to 20" in diameter.

- Hand thinning stand treatments include hand cutting of trees along with hand piling of material for burning, underburning, or mechanical chipping and mastication.
- There are stands that would not be feasible to treat with ground-based equipment where hand thinning would not be sufficient to fully achieve the desired stand densities (basal areas less than 150 ft^2 per acre) or change in expected fire behavior, due to the limitations on the maximum diameter for trees being removed. In order to achieve desired fuel reduction, these stands would need to receive follow-up treatments with other types of mechanized equipment (cable yarding, helicopter, etc) to remove a portion of the larger diameter understory trees in order to achieve their desired condition.

Mechanical Thinning - SEZs

- Mechanical equipment operations in SEZs would be limited to CTL operations or operations using equipment that has been demonstrated to adequately protect soil and water resources (i.e. equipment that is lighter on the land, rubber-tired equipment, equipment that operates on a bed of slash, or other innovative technologies that reduce impacts to soils).
- South Shore SEZ stands that exhibit equal or less sensitivity than the Heavenly Valley Creek SEZ demonstration project (HSEZ) site based on the sensitivity rating system (Appendix D) may be treated with ground- based equipment under operable soil moisture conditions.
- SEZ stands that rate more sensitive than the HSEZ project site would be treated by hand crews, endlining, or mechanical over-snow operations.
- When stands are rated more sensitive than the HSEZ site, but only a portion of the stand is responsible for the high sensitivity rating, the less sensitive part may be treated with mechanical equipment, but the sensitive portions of these stands would be treated by hand crews, endlining, or mechanical over-snow operations. Areas with wet soils or other sensitive features would be flagged for hand treatment prior to commencement of mechanical operations.
- To achieve the desired conditions for fuel loads, stand densities, and desired stream shading, dead and live trees removed would range between 3 to 30” dbh, beginning with the smallest diameter and retaining the largest trees. Treatments would include the removal of primarily understory, and some overstory trees, in order to reach the desired residual stand density and wildfire behavior.
- Snags and down logs would be removed as necessary to meet fuels objectives, beginning with the smallest diameter and retaining the largest snags and down logs present to meet Forest Plan wildlife and soils requirements.
- Basal areas greater than 150 ft^2 and fuel loads in excess of 15 tons per acre may be prescribed where needed to maintain desired stream shading.
- Jeffrey/ponderosa, and sugar pine would be favored for retention, as well as desired riparian species, such as aspen and willow.
- Treated material would be removed as saw logs, fuelwood, or biomass.
- Fuel material not removed would be treated on site through prescribed burning, chipping, or mastication. To provide ground cover and protect soil resources in areas of ground disturbance, including skid trails and temporary roads, masticated or chipped material would be spread over the disturbed areas, with a maximum depth of approximately 4”

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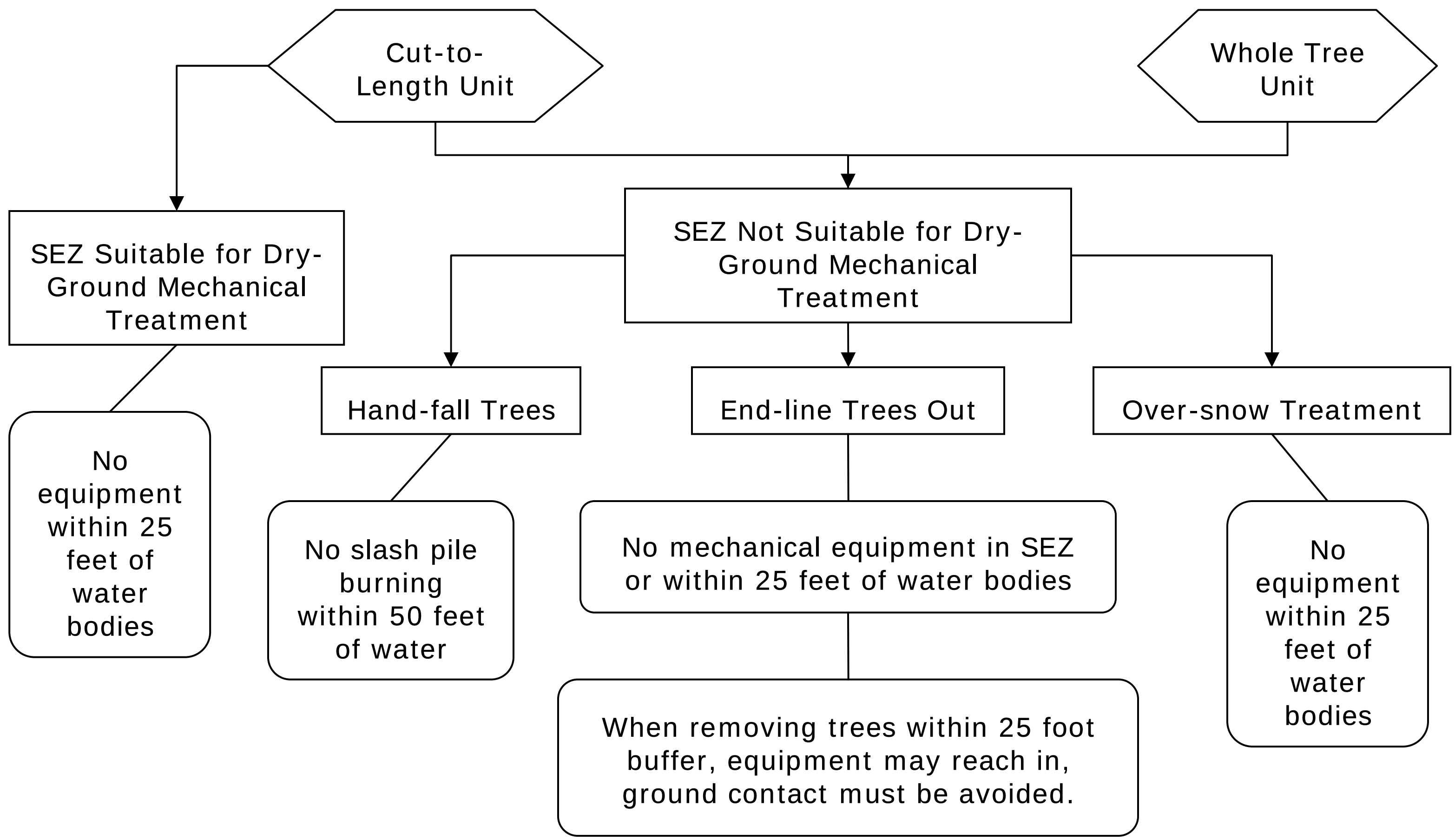
SEZ Treatment Options



Hand Thinning - SEZs

- Hand thinning in SEZs would include the same treatments as described for hand thinning in uplands to remove primarily understory, and some overstory trees based on the desired residual stand density and expected wildfire behavior.
- Basal areas and fuel loads sufficient to maintain desired stream shading would be retained.
- Where possible without disturbance to the lake shore or stream channel, ground fuels exceeding 15 tons/acre would be removed from the 50-foot buffer around lakes and stream channels and then would be treated by hand piling and burning.

Prescribed Fire

- Prescribed fire would be planned to ensure that fire intensity and duration do not result in detrimentally burned soils.
- Underburning prescriptions would be designed to avoid adverse effects on soil and water resources. Flame heights would not exceed two feet within 50 feet of stream courses or on wetlands unless higher intensities are required to achieve specific objectives consistent with the Forest Plan standards, above.
- No ignition would be allowed in SEZs; fire would be allowed to back into these areas.
- Specific prescribed fire design criteria would apply within SEZs to address the resource concerns associated with burning piles in SEZs:
    - Maintain a 50-foot buffer (no piling or burning) along perennial or intermittent streams, lakes, bogs, and fens.
    - Permit piling and burning up to 10 feet from the edge of ephemeral channels.
    - Allow fire to creep between piles and into this buffer, maintaining flame lengths of less than 2 ft in height, except where sensitive plant occurrences, fens, and the noxious weeds whitetop and cheatgrass are present.
    - Permit piling and burning up to the edge of ephemeral channels, but piles would not be placed in the channel.
    - Place piles in a non-linear pattern in each unit where possible.
    - The maximum pile size would not exceed 10-foot diameter by 5-foot height.
    - No more than 30% of any SEZ acre may be occupied by piles.
    - No more than 15% of any SEZ acre may be burned each year.
    - Maximize the distance between piles to the extent feasible, maintaining approximately 20 ft average spacing between piles in each unit.
    - After initial ignition of piles, but while still burning, allow each pile to be re-piled once (i.e. place large unburned pieces back into the burning pile). Additional re-piling will be allowed if necessary to achieve 80% consumption of the piled material.
    - Hot piling of burn piles is prohibited within SEZs (i.e. don't feed one pile with the material from other piles or ground material), unless necessary to meet desired fuel load conditions.
    - When piles are adjacent to aspen trees, re-piling during pile burning shall be restricted to one time per pile and hot piling is prohibited without exception.

Reforestation

There are areas in the project where promoting species diversity could prove beneficial for increasing insect and disease resistance as well as establishing a trend toward desired conditions. Reforestation could occur in areas where fuels treatments and thinning create openings after treatment.

Meadows and Aspen Stands

- For meadows and aspen stands where lodgepole pine and other conifer species are encroaching, the prescribed treatment would include the removal of live conifers to increase the amount of hardwoods and other meadow vegetation that currently exists.
- The general prescription for hand treatments would primarily include removing all live conifers up to 14" dbh and falling and removing all standing dead conifers up to 20" dbh. All dead and down conifers up to 20" dbh would also be removed.
- Mechanical treatments could include the removal of all conifers up to 30" dbh with the exception of trees greater than 150 years old exhibiting characteristics such as flat tops, large limbs, and large bark plates. Prescribed burning in meadows post-thinning could also be included for treatment.
- Vegetation treatments proposed within meadow ecosystems would result in:
    - decreased conifer crown closure;
    - increased riparian vegetation cover over the long-term;
    - occurrences of both herbaceous and woody species of varying heights over the long-term;
    - retention of large woody debris (LWD) of 10 to 15 tons per acre of the largest size classes with all decay classes represented; and
    - retention of snags in or near the meadow ecosystem or riparian corridor of up to 3 snags per acre of the largest sizes, in a range of decay classes where feasible.
- Vegetation treatments proposed within aspen stands (approximately 290 acres in Alternative 2 and 251 acres in Alternative 3) would result, where possible, in:
    - Average conifer crown closure less than 25%;
    - average aspen crown closure greater than 40%;

Aspen grove, desired condition

    - aspen crowns comprising more than half the canopy;
    - aspen crowns overtopping conifer crowns;

- aspen regeneration (approximately 500 stems per acre) occurring or likely to occur within 3 to 5 years;
- conifer encroachment not likely to occur or minimal within the next 15 years.

The LTBMU/Rocky Mountain Research Station General Technical Report-178 “Ecology, Biodiversity, Management, and Restoration of Aspen in the Sierra Nevada” (Shepperd et al. 2006) and findings of the Aspen Community Mapping and Assessment Project (located in LTBMU files) would be used in developing site-specific vegetation treatment recommendations for aspen habitat within the proposed action area. Integrated project design includes the site-specific BMPs for aspen found in Appendix C.

Treatment Duration

Depending on individual conditions for treated stands, an increase in stand density and fuel load accumulation are expected to occur over time (15-20 years). While treatments from this project are expected to remain effective for 15-20 years, future treatments would be required to maintain stand densities and fuel loads within the range of desired conditions.

Summary of fuels and vegetation treatment design features

- No activities are proposed within congressionally designated Wilderness Areas (Map 21).
- Treatments would not create any new roads within Inventoried Roadless Areas (Map 21).
- Stands would be prioritized for treatment by the proximity to places where people live and work (defense and threat zones of the WUI), existing fuel hazard levels, and other resource concerns such as watershed recovery, wildlife habitat requirements, and visual quality objectives.
- Stands identified for treatment are overly dense forest stands with fuel accumulations at levels greater than the desired condition.

Example of previously treated area

- Stands are designated for mechanical or hand fuels treatments based on soil type, slope of treatment stands, and associated water quality concerns such as delivery of sediment to surface water.

- Treatment methods would depend on the vegetation removal needs, to include: whole tree yarding, cut-to-length, biomass chipping, mastication, and prescribed burning.
- Prescribed burning would be used to reduce fuels; reduce slash created by treatment activities; and to re-introduce fire's ecological function.
- Scheduling of prescribed burn activities would comply with air quality standards and restrictions.
- RCAs/SEZs, including meadows and aspen stands, needing fuels treatments would be evaluated for mechanical treatments or receive hand treatments.

Urban Lot Resource Objectives

Urban lots are small parcels of undeveloped forest land acquired by the Forest Service, usually located within or directly adjacent to developed subdivisions. The average size of these urban forest parcels is 0.3 acres. Treatment objectives include:

- ➢ Reduce the potential for catastrophic wildfire.
- ➢ Provide defensible space to adjoining private lands consistent with SNFPA standards for fire behavior and safety for fire suppression personnel.
- ➢ Restore riparian vegetation communities (aspen stands, willow, etc.) through the removal of encroaching conifers.

Design features to meet urban lot objectives

Urban lots included for treatment in the South Shore project exhibit the same fuel loads and need for treatment as other areas in the Lake Tahoe Basin. These include urban lots containing SEZs with conifer encroachment and fuels build up, as well as urban parcels in excess of 5 acres contiguous land base. Removal of hazardous fuels and thinning of dense stands is needed to reduce the potential for catastrophic wildfire and to provide defensible space to adjoining private lands. Thinning and removal of live conifers encroaching into SEZs and removal of hazardous ground fuels in SEZs are needed to reduce the potential for negative effects of a catastrophic wildfire in these environmentally sensitive areas.

Treatment prescriptions have the same objectives as in other parts of the project area: modify fire behavior, reduce hazardous fuels adjoining developed private lands, and where applicable, restore riparian vegetation communities (aspen stands, willow, and meadows) through the removal of encroaching conifers. Treatment options would consider ground based mechanical treatments whenever slope and access allow (including SEZ areas).

Mechanical and hand thinning of uplands would follow the same decision process and design features as described for vegetation and fuels objectives. Mechanical and hand thinning of SEZs would follow the same SEZ decision process and design features as described for vegetation and fuels objectives. Hand thinning of urban lots could remove trees up to 30" dbh where necessary to meet fuels objectives and fuelwood utilization is feasible. On urban lots where fuelwood access is limited or infeasible, hand thinning would be limited to trees up to 14" dbh.

Dead, dying, and diseased trees of all sizes often present a hazard to life and property due to the close proximity of homes, roads, utilities, and other improvements associated with development. All trees identified as a hazard to life and property would be removed regardless of diameter, including trees greater than 30" dbh.

Summary of urban lot design features

- Treatment prescriptions would be designed to modify fire behavior to meet SNFPA (2004) desired conditions for defense zones.
- Encroaching conifers would be removed to restore riparian vegetation communities.
- Ground based mechanical treatments would be used whenever soils, slope, and access allow (including SEZ areas).
- All trees identified as a hazard to life and property would be removed regardless of diameter, including trees greater than 30” dbh.

Wildlife Habitat Objectives

- ➢ Use updated northern goshawk and California spotted owl land allocations on the LTBMU based on historic and current nest location and habitat information following SNFPA direction (USDA FS 2004; pp. 37-40).
- ➢ Within the WUI defense zone, CA spotted owl and northern goshawk PACs, owl HRCAs, and TRPA wildlife disturbance zones could be treated as determined by surveys of existing vegetation and fuels conditions.
- ➢ PACs in the WUI threat zone would not be treated unless existing hazardous fuels conditions merit entering the PAC.
- ➢ Follow SNFPA (2004) standards and guidelines (#’s: 7, 33, 34, and 71-81) for vegetation treatments within northern goshawk and California spotted owl PACs and HRCAs.

California spotted owl

- ➢ In areas where treatment stands are located in close proximity to one another, vegetation treatments within those stands would be separated in time where possible, rather than treated all at once, to provide refuge for wildlife during implementation (i.e., in a group of three PACs, treat only one of the three in any given year).

- Follow TRPA Code of Ordinances (2004) for habitat disturbance within disturbance zones designated for special interest species (Ch. 78.3.A).
- Use limited operating periods for special status species following LRMP (1988) and SNFPA (2004) direction as shown in Appendix A in the Wildlife BE/BA (located in the project file) in areas where these species occur in the project.
- Use known osprey nest sites to develop site-specific vegetation treatment recommendations (as explained in the following section) for the retention and development of large, over-mature snags within the proposed action area in the Fallen Leaf and Echo management areas.
- Use the TRPA bald eagle wintering habitat mapped between Emerald Bay and Taylor Creek and data from LTBMU habitat evaluations (1994), perch sites (1997-8), in developing site-specific vegetation treatment recommendations for bald eagle habitat within the proposed action area in the Fallen Leaf management area.

Current survey activity and analysis for design features to meet terrestrial wildlife habitat objectives

There are currently nine California spotted owl PACs and HRCAs and 16 northern goshawk PACs designated on the LTBMU (Map 17) within the South Shore project analysis area.

Northern goshawk

The LTBMU proposes to conduct vegetation treatments within PAC, HRCA, and TRPA wildlife disturbance zone land allocations following current management direction, including SNFPA (2004) standards and guidelines. Within the WUI defense zone, PACs, HRCAs, and goshawk disturbance zones would be treated according to the design features below. In the WUI threat zone, HRCAs and wildlife disturbance zones could be treated when necessary to create or maintain effective distribution of SPLATs over the landscape. In the WUI threat zone, PACs would only be treated when existing hazardous fuel conditions merit entering the PAC.

In areas where PACs are located in close proximity to one another, vegetation treatments within those PACs would be separated in time, rather than treated all at once, to provide refuge for the relevant species during implementation. The LTBMU proposes to treat more than 5% per year and/or 10% per decade of PAC acres on the Forest for both California spotted owl and northern goshawk, but does not expect to exceed bioregional standard and guidelines given in the SNFPA (USDA FS, SNFPA 2004 ROD pg. 78-81) for Sierra Nevada national forests (pers. comm. Patricia Krueger, USFS Regional Office, 2006).

In 1987, TRPA designated a 2,473 acre bald eagle wintering habitat threshold area around Emerald Bay, Cascade Lake, Tallac Creek, and Taylor Creek (Map 17). The TRPA bald eagle threshold is supported by the 1988 Forest LRMP (p.III-24). In 1994 the LTBMU evaluated potential bald eagle perch sites along the Lake Tahoe shore zone from Camp Richardson to Tallac Point; as a result, seven dominant trees were selected for pruning and tree retention for this species. Bald eagle habitat use surveys conducted in the Fallen Leaf management area in 1997 and 1998 further identified perch sites in the 1994 evaluation area, in Taylor Creek wetland, along Taylor Creek, and around Fallen Leaf Lake. The LTBMU proposes to conduct vegetation treatments, as determined by surveys of existing vegetation conditions, within the TRPA bald eagle winter habitat mapped between Emerald Bay and Taylor Creek, and in the Fallen Leaf management area following current management direction and consistent with the habitat evaluations completed in 1994 and the perch sites identified in 1997-8.

The LTBMU proposes to identify and retain suitable large trees within stands historically or currently used by osprey for perching or nesting. Osprey nest surveys conducted annually in the Lake Tahoe Basin since 1990 by California Department of Parks and Recreation, TRPA, and the LTBMU would be used to identify historic and current osprey nest trees and stands. All known standing osprey nest trees within the proposed action area would be retained. Future recruitment of large trees suitable for osprey perching and nesting on the forest is a management concern.

Osprey

Future recruitment of suitable osprey nesting and perching trees would be addressed by identifying and retaining an average of at least three suitable large trees per acre in treatment stands located adjacent to Fallen Leaf Lake and Lower Echo Lake.

The LTBMU proposes to conduct vegetation treatments within aquatic, riparian, and meadow ecosystems, as determined by surveys of existing vegetation conditions and following current management direction. The Forest conducts willow flycatcher, wetland bird, fish and/or invertebrate species surveys in these habitats annually. The Forest also recently completed multi-species inventory and monitoring (MSIM) project surveys, which surveyed several suites of wildlife and botany communities during a four-year period (unpubl. data 2001-02, 2004-05). The results of these survey efforts would be used to assist in designing the location, extent, timing, and prescription of vegetative treatments proposed by the Forest Service and in monitoring the response of terrestrial and aquatic wildlife and botany communities to the treatments.

Special status wildlife species

Wildlife objectives and design features for this project are centered on land allocations for consistency with regional and forest management direction; TRPA disturbance zones for TRPA wildlife resource management provisions; and on ecosystem types to address the interconnectedness of natural resources within the primary objective of the project (hazardous fuels reduction). The project would affect vegetative characteristics of focal wildlife species habitats on the forest. Special status, or focal, wildlife species for the South Shore project area include those listed as threatened (T), endangered (E), candidate (C), or de-listed (D) by the FWS; sensitive (S) by the Regional Forester, or management indicator species (MIS) by the LTBMU Forest Plan (USFS); and special interest species (SIS) by the TRPA. Limited operating periods (LOPs) would apply, following the recommendations of the South Shore project's wildlife biologist or Forest biologist, consistent with SNFPA (2004), LRMP (1988), and TRPA Code of Ordinances direction for wildlife species.

Wildlife habitat design features

- Conduct vegetation treatments in up to ~1,325acres within northern goshawk PACs, up to ~855 acres within California spotted owl PACs, and up to ~1,930 acres within TRPA goshawk disturbance zones that result in at least: 1) two tree canopy layers; 2) dominant and co-dominant trees with average diameters of 24" dbh; 3) 60 to 70 percent canopy cover; 4) an average of five to eight snags (five in eastside pine and mixed conifer, six in westside pine and mixed conifer, and eight in red fir forest types) per acre larger than 20" dbh and of variable decay classes; and 5) 15 tons of course woody debris (CWD) per acre larger than 20" in diameter (at the large end) and of variable decay classes. These conditions would be met where possible, otherwise as closely as possible, while also meeting fuel reduction objectives.
- Conduct vegetation treatments in up to ~3,005 acres within California spotted owl home range core areas (HRCAs), that result in at least: 1) two tree canopy layers; 2) dominant and co-dominant trees with average diameters of 24" dbh; 3) 50 to 70 percent canopy cover; 4) an average of three to six snags (three in eastside pine and mixed conifer, four in westside pine and mixed conifer, and six in red fir forest types) per acre larger than 20" dbh and of variable decay classes; and 5) 10 tons of CWD per acre larger than 20" in diameter (at the large end) and of variable decay classes. These conditions would be met where possible, otherwise as closely as possible, while also meeting fuel reduction objectives.
- Conduct approximately 165 acres of vegetation treatments within the TRPA bald eagle wintering habitat area near Taylor Creek and Tallac Creek adjacent to wetland, wet meadow, and open water habitats that result in: 1) late successional forest type, with an emphasis on Jeffrey pine-dominated stands; 2) retention of trees that are larger in diameter and taller than the dominant tree canopy, with an emphasis on trees greater than 40" dbh and greater than 98 feet tall and on dead topped trees with robust, open branch structures; 3) an average of six snags per acre larger than 20" dbh and of variable decay classes. These conditions would be met where possible, otherwise as closely as possible, while also meeting fuel reduction objectives.

Bald Eagle

- Conduct vegetation treatments in up to ~1,070 acres within osprey stands adjacent to Fallen Leaf Lake and Lower Echo Lake that result in: 1) retention of all known standing osprey nest trees; and 2) retention of an average of three trees per acre that are larger in diameter and taller than the dominant tree canopy, with an emphasis on dead topped trees with robust, open branch structures. These conditions would be met as closely as possible, while also meeting fuel reduction objectives.

Fisheries Habitat Objectives

- SEZ fuels reduction treatments in identified Lahontan cutthroat trout habitat are designed to avoid negative habitat effects and meet Endangered Species Act (ESA) requirements. (While habitat for Lahontan cutthroat trout does exist in the project area, there are no known populations in the project area.)
- Reduce the hazard levels for high severity wildfire in RCA/SEZs.
- Provide stream shading and large woody debris hiding cover for high quality trout habitat. This could include the addition of felled trees in reaches that are lacking large woody debris.
- Where fish species of interest are present (for example, rainbow trout, brook trout) ensure Forest Plan standards and guidelines for habitat are met.
- Maintain or enhance connectivity within and between watersheds to provide physically, chemically, and biologically unobstructed movement of riparian and aquatic dependent species needed for their survival, migration, and reproduction.
- Retain vegetative cover to ensure that daily mean water temperatures do not increase and provide high quality habitat for trout species.

Current survey activity and analysis for design features to meet fisheries habitat objectives

Large woody debris surveys are underway for the streams within the South Shore project area, including 98 miles in Alternative 2 and 92 miles in Alternative 3 of streams where treatments are proposed. Surveys identify areas where fisheries habitat could be directly or indirectly improved through fuels treatments. In addition to LWD surveys, fish crews conducted biological surveys where data gaps were present in the current GIS layer. The purpose of those surveys is to maintain consistency with the forest plan, and to identify any previously undetected trout species and/or Lahontan cutthroat trout sites.

Saxon Creek deadfall

Fisheries and aquatic habitat design features

- Evaluate the time of year for mechanical treatments to avoid impacts to fish migration and/or spawning, or use hand treatments in riparian RCAs/SEZs needing fuels treatments adjacent to fish habitat.
- Leave existing downed trees and LWD that are in perennial or intermittent stream channels in place unless channel stability needs, as determined by an LTBMU hydrologist, dictate otherwise (LRMP STD/GD 15)
- Remove fuels in SEZs with an overload of standing and down fuels, such as stream reaches that exceed 75% stream shading from dead and down or ladder fuels, while maintaining enough shade to ensure that daily mean water temperatures do not increase.
- To avoid removing or altering bank stabilizing vegetation, trees may be marked for removal (live or dead) within 5 feet of the bank edge of perennial or intermittent streams and lakes only where fuel loads or stand densities exceed prescription and where LWD is at or above desired levels.
- Directional falling would be used to keep felled trees out of intermittent and perennial streams unless the channel reach is identified as deficient in large woody debris, in which case a Forest Service fisheries biologist and watershed specialist would select trees greater than 12” dbh to be felled directionally into the channel.
- Place trees larger than 12” dbh into the stream, where streams lack large woody debris for fish habitat, in locations prescribed by a Forest Service fisheries biologist and watershed specialist.
- Maintain shaded bank conditions on trout streams by retaining at least 50% of the stream bank site potential for herbaceous and shrub cover and at least 25% of the site potential for

tree cover. Where natural tree cover is less than 20%, 80% of the potential would be retained. Thirty-five to 70% of the stream would be shaded from 11:00 AM to 4:00 PM. (LRMP STD /GD 20). The purpose of this standard is to maintain levels of stream shade to ensure that there is no measurable increase in daily mean water temperatures where fuel reduction occurs.

Saxon Creek stream shading

Watershed, RCA/SEZ, and Water Quality Objectives

- Meet the riparian conservation objectives of the forest plan, as amended by the SNFPA (2004).
- Reduce risk of wildland fire effects to watershed conditions and provide the water quality and soil productivity necessary to support ecological functions and beneficial water uses.
- Meet California State water quality standards.
- Minimize the number of watersheds that exceed the threshold of concern due to fuels treatments.
- Minimize the addition of equivalent roaded acres in the watersheds currently over-threshold from existing development and other land disturbances.
- Avoid disturbance of the connections between floodplains, channels, and water tables to distribute flood flows and sustain diverse habitats.
- Reduce the risk of wildfire effects to in-stream flows in order to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats (i.e., reduce the risk of increasing sediment regimes that would be expected to occur from wildfire).
- Reduce the risk of wildfire effects to the physical structure and condition of stream banks and shorelines in order to minimize erosion that would be expected to occur from wildfire.

- Avoid disturbance in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes) in order to perpetuate their unique functions, biotic communities, and biological diversity.

Design criteria to meet watershed and riparian conservation objectives

An iterative process was used to schedule the treatment units in order to reduce the impacts on any particular watershed and minimize the number of watersheds that exceed the threshold of concern due to fuels treatments. A comparison of watershed recovery capacity between fuel treatments and two severity classes of wildfire provided additional information for the project design.

A SEZ sensitivity rating system was developed based on the results of the Heavenly Valley Creek SEZ demonstration project to evaluate mechanical treatments for South Shore SEZ units. The USFS LTBMU SEZ sensitivity rating system was reviewed and approved by the TRPA and Lahontan Water Board (May 30, 2008).

In order to minimize impacts to water resources from the proposed activities, standard BMPs (Appendix C) would be implemented (USDA FS 2000). The riparian conservation objectives (RCOs) in the SNFPA (2004) are incorporated in the design for the project. These objectives address provision of beneficial uses for water resources, geomorphic and biological characteristics of aquatic features, suitable stream habitat features (including LWD), and physical and biological characteristics of riparian areas.

In addition, project specific design features have been developed to reduce or avoid both direct and indirect negative effects of treatments on forest resources.

Water and riparian design features

- Temporary roads, skid trails, and landings would be closed and stabilized to provide drainage and prevent water accumulation on the roadbed and sedimentation into stream channels at the conclusion of the project (see Soils and Transportation sections for additional information).
- Landings, fuel storage, and refueling in RCAs would be prohibited unless no feasible alternative exists.
- Landings would not be located in SEZs (BMP #1-12), and no fuel storage or refueling would take place in SEZs.
- Ground based equipment would not operate within 25 feet of the high water line of lakes and ponds, but could reach in to remove material.
- Ground based equipment would not operate within a minimum 25 feet. of perennial or intermittent stream channels except at temporary or permanent stream (BMP #1-19), but could reach in to remove material.
- In and adjacent to special aquatic features (springs, seeps, vernal pools, fens, and marshes) equipment use would be avoided. Only hand treatments would be allowed in these flagged areas (BMP #1-22). See Botany prescriptions for specific buffers.
- Mechanical equipment operations in SEZs would be limited to CTL operations or other innovative technology equipment that has been demonstrated to adequately protect soil and water resources (i.e. equipment that is lighter on the land, rubber-tired equipment, equipment that operates on a bed of slash, or other innovative technologies that reduce impacts to soils).

  - South Shore SEZ stands that exhibit equal or less sensitivity than the Heavenly Valley Creek SEZ demonstration project (HSEZ) site based on the sensitivity rating system (Appendix D) would be treated with ground based equipment under operable soil moisture conditions.
  - SEZ stands that rate more sensitive than the HSEZ project site shall be treated by hand crews, endlining, or mechanical over-snow operations.
  - When stands are rated more sensitive than the HSEZ site, but only a portion of the stand is responsible for the high sensitivity rating, the less sensitive part may be treated with mechanical equipment, but the sensitive portions of these stands must be treated by hand crews, endlining, or mechanical over-snow operations. Areas with wet soils or other sensitive features shall be flagged for hand treatment prior to commencement of mechanical operations.

- Design criteria to protect the Grass Lake Research Natural Area (Map 21):
  - Ground-based equipment shall stay on road 11N13 until completely inside the treatment stand boundary.
  - An erosion control fence shall be installed along the eastern edge of the road where adjacent to the culvert crossing before commencing operations.
  - Access to the treatment stand west of road 11N13 would be limited to the time of year when the road surface is dry.

Soil Resource Objectives

- Maintain soil productivity while meeting vegetation treatment objectives.
- Reduce the potential for negative impacts to the soil resource from high intensity wildfire by using vegetation treatments to reduce fire intensity that affects soil productivity.
- Reduce the risk for wildfire effects to soils in order to maintain soils with favorable infiltration characteristics and diverse vegetative cover to absorb and filter precipitation and sustain favorable conditions for stream flows.

Soil resource design features

Removal of hazardous fuels and thinning of dense stands is necessary to reduce the risk of catastrophic wildfire, which can significantly impact soil productivity. Wildfires remove litter and duff layers that protect soils from the erosive forces of water and wind, and remove plant nutrients from the soil system. The intense heat generated by wildfires can also burn organic compounds in the soil below the ground surface, further reducing nutrient stores and creating water-repellent soil layers. When water-repellent conditions are created, infiltration is inhibited, resulting in increased runoff and increased erosion potential, with impacts to soil productivity and water quality.

Soil type and slope data were analyzed to determine areas that are suitable for mechanical treatments. Vegetation treatments would be designed to minimize adverse effects to soils, maintaining productivity as described in the Region 5 Soil Quality Standards (USDA FS 2004). The Region 5 Best Management Practices (BMPs) (USDA Forest Service 2000) for roads and equipment use for tree and fuel removal would be employed to prevent detrimental erosion. BMPs specific to prescribed burning would be used to prevent negative effects to soils from prescribed fire duration or intensity. See Appendix C for a list of BMPs that would apply to the South Shore project.

- Reduce erosion potential through use of BMPs.

- Use mechanical treatments to reduce upland hazardous fuels on slopes less than 30% and less sensitive soils.
- Use hand treatments, end-lining or equipment reach to reduce hazardous fuels on slopes greater than 30% (BMP #5-2).
- Use equipment that is lighter on the land, e.g., rubber-tired equipment, equipment that operates on a bed of slash, and other innovative technologies that reduce impacts to soils.
- Allow ground based equipment operations only when soil moisture conditions are such that compaction, gullying, and/or rutting would be minimal, or when snow conditions are at depth and temperatures, as determined by a watershed specialist, are suitable for over-the-snow operations (BMP #1-13 and 5-6).
- Soil moisture conditions would be determined at the 6-10 inch depth and dry to moist soils at this depth, as determined by a USFS watershed specialist, will indicate operable moisture conditions (Additional detail in Appendix D).
- The following criteria would apply to vegetation treatments outside of the normal operating period. Normal operating period is generally considered to be from May 15 through October 15 each year.
    - Conditions in treatment units must be adequate to prevent erosion and detrimental soil compaction.
    - Operable conditions must be present on at least 85% of the treatment unit[1] and generally will include the following:
    - For frozen soil operations, a minimum 3 inch depth of frozen soil shall be maintained throughout the treatment unit and on all access roads.
    - For over-the-snow operations, a minimum of 12 inches of compact snow/ice shall be maintained on undisturbed ground, and 6 inches of compacted snow/ice shall be maintained on existing disturbed surfaces.
    - Lesser depths may be agreed to by a Watershed Specialist and the sale administrator.
    - If sedimentation to a natural water body is likely operations will not occur.
    - If operable soil moisture conditions are present beneath a lesser snow depth (i.e. <6 inch), operations may continue until soil moisture conditions are outside conditions defined as operable. Use the table in the SEZ sensitivity rating to determine operable soil moisture conditions.
    - Avoid springs, seeps, and other areas that do not freeze well.
    - When working outside of the normal operating period, monitor operations regularly to ensure that adequate snow and frozen soil depths are maintained and that soil and water quality impacts are not occurring.
    - Move equipment and materials to areas near pavement before soil moisture conditions are outside conditions defined as operable. Use the table in the SEZ sensitivity rating to determine operable soil moisture conditions.
    - For over-the-snow and frozen soil operations in SEZs, exclude ground based equipment from the 25 foot buffer around perennial and intermittent channels.
    - Temporary crossings on intermittent or ephemeral channels may be approved on a case by case basis through agreement between the sale administrator and a watershed

[1] 85% is consistent with the design feature that no more than 15% of the unit may be left in a detrimentally disturbed condition. These design features are consistent with National and Regional Forest Service policy for maintenance of soil quality.

specialist, and the conditions of the agreement shall be documented. These crossings shall not result in bank damage or water quality impairment.

- Where it is necessary to cross an area with inoperable soil moisture conditions, equipment shall operate over a slash mat, landing mat, or other protective material to minimize soil compaction.
- Where small areas of slopes greater than 30% are present in a unit, trees would be hand-felled, and the logs end-lined to a part of the unit where they could be picked up by heavy equipment.
- To the extent practicable, where end-lining occurs on slopes above 10%, end-line material along slope contours (i.e. cross-slope) to avoid creating ruts in the soil that could occur if removal were oriented downhill. Where implementation monitoring finds potential for sediment delivery, rake in the berms from ruts created by end-lining.
- Ground based equipment in whole tree (WT) treatment stands shall not operate in SEZs or stream channel buffers. Treat SEZ areas within WT stands with hand crews, leaving the resulting logs in place.
- To achieve desired fuel loading in SEZs within WT units, trees may be end-lined out of the SEZ after consultation with a watershed specialist. Slash in excess of 15 tons per acre shall be removed by hand from the 50-foot buffer from stream channels and lakes, piled and burned.
    - Prohibit tree removal methods that disturb the ground surface within 25 ft of a perennial or intermittent stream channel or other water body (e.g. lakes, ponds).
    - Provide ground cover adequate to prevent erosion in disturbed areas, such as slash, wood chip, or masticated material.
    - Where implementation monitoring finds potential for sediment delivery, rake in the berms from ruts created by end-lining.
- No more than 15% of the treatment area would be left with detrimental soil disturbance by skid trails and landings. If more than 15% of the soil in a given treatment area is detrimentally disturbed by skid trails and landings as estimated by a watershed specialist, the contractor would be responsible for rehabilitating portions of the area to stay below 15% detrimental disturbance (BMP #1-15).
- Install water bars on skid trails to provide proper drainage and prevent erosion when operations are complete and before large precipitation events (BMP #1-17). Design and spacing of water bars would be in accordance with the Forest Service Timber Sale Administration Handbook (USDA FS 1992).

Summary of soil resource design features

- Operate heavy equipment on dry soils and treat extensive areas of detrimentally compacted soils (temporary roads and large landings).
- Use mechanical treatments to reduce upland hazardous fuels on slopes less than 30% and less sensitive soils.
- Use hand treatments to reduce hazardous fuels within sensitive soils and slopes greater than 30%.
- Reduce erosion potential through use of BMPs.

- Plan prescribed fire to ensure that fire intensity and duration do not result in detrimentally burned soils.

Sensitive Plants Objective

➢ Minimize negative impacts to sensitive plants and their habitats from fuel reduction activities.

Sensitive plant design features

- Survey and locate sensitive plants prior to project implementation.
- Flag, buffer, and avoid sensitive plant locations where occurrences are identified during current surveys, or found during implementation, where they could be negatively affected by project activities.
- Provide for equipment operations without disturbance to plant populations by placing protective boundaries, including a flagged buffer around sensitive plant locations.
- Use hand treatments to reduce fuels in sensitive plant locations.
- Do not locate burn piles within the flagged sensitive plant area.
- Follow site-specific operating procedures (i.e., flagged route for conifer removal) adjacent to fens or wet meadows where sensitive plants are likely to occur, to prevent negative effects to these sensitive plants or their habitat.

Noxious Weed Objective

➢ Reduce the likelihood of introduction or spread of noxious weeds within the treatment areas.

Noxious weed design features

- Survey and locate noxious weeds prior to project implementation.
- Flag and avoid or treat known noxious weed locations (e.g., previously used landings and temporary roads) prior to project implementation.
- Implement noxious weed prevention practices, such as washing equipment if the previous location is either unknown or is infested with weeds, in compliance with the state and SNFPA (2004) standards.

Recreation Objectives

➢ Ensure public safety during fuel reduction activities with temporary area closures and information/regulatory signs when and where equipment and activities would pose a hazard to the public.

➢ Discourage post-treatment establishment of user-created routes within treatment areas, as described in the transportation section.

➢ Reduce hazardous fuels within and surrounding special use recreation sites within the South Shore area, including resorts, recreation residence tracts, and day use areas such as Baldwin Beach.

➢ Schedule project activities to minimize disruption to peak season use at developed recreation sites, such as campgrounds, recreations residences, and resorts when practical.

➢ Provide environmental education regarding: 1) the need for and expected benefits from fuels reduction, 2) the activities expected to occur, and the appearance of activities as they are in progress, and 3) the effect of fuel reduction activities on recreation opportunities as described below.

Recreation background and design features

With the fourth highest level of recreation visitor use of the National Forests in California, the LTBMU has one of the highest densities of visitor recreation per acre in the entire National Forest system. In order to protect public health and safety, and to minimize impacts to the LTBMU recreation resources within the proposed fuels reduction treatment areas, the following recreation design features would be integrated into the project.

Temporarily close public access to dispersed recreation opportunities: When necessary to ensure public health and safety, public access to dispersed recreation opportunities would temporarily change at locations undergoing fuel reduction operations. A Forest Order would be issued to enforce the temporary area closures and provide public safety. Management activities would be planned to minimize the duration of closures when public access closures to dispersed campgrounds, trailheads, and trails are needed to protect the public from hazards associated with fuel reduction treatment activities. Potential closures would be scheduled to avoid peak use periods when practical, and to allow visitors access to nearby opportunities (i.e., only those recreation resources immediately undergoing work would be closed – not an entire area). Additionally, recreation closures would be planned in advance and the public would be notified.

Discourage post-treatment establishment of user-created trails: As a result of fuel reduction treatments, areas that were once too dense to allow off-highway vehicle (OHV), over snow vehicle (OSV), or mountain bike use could become open enough to appear attractive for unauthorized use. Regulatory signage would be clearly posted to notify users of designated limitations. Where unauthorized access is clearly tempted by changed forest conditions, such as areas between existing trails or between an existing trail and destination point, strategically placed barriers such as boulders and felled logs would be incorporated to direct users onto designated trails. The Forest Service has completed road and trail access and travel management (ATM) plans for the project area, with the exception of the Fallen Leaf area. The Fallen Leaf Lake, Freel, and Meiss Road and Trail ATMs identify existing authorized and user-created roads and trails, analyze resource impacts, and prescribe trail improvements, re-routes, adoption of key non-system trails, and removal of undesirable trails. The resulting trail system would promote responsible land stewardship and would meet the majority of users' needs, as well as result in a reduction in the number of user-created trails. The South Shore project would be consistent with the road and trail ATM plans. Establishment of user-created trails resulting from South Shore project fuels reduction work would be monitored following treatment implementation. Law enforcement patrol of these areas and restoration of any user-created trails would occur within funding limitations.

Remove hazard fuels within and surrounding Special Use permitted recreation sites: Special use-permitted recreation residences and resorts are located within the project area and within the WUI. The proposed fuel reduction project would treat hazardous fuel loading within resort permit boundaries as well as areas adjacent to these boundaries to reduce the risk of fire spreading within these properties. For example, the South Shore project would treat hazardous fuels loading within resort permit boundaries at Camp Richardson as well as areas adjacent to these boundaries to reduce the risk of fire spreading within these properties. Fuel reduction treatments are also proposed within the special use permit area of Baldwin Beach day use area. Fuel conditions that exceed desired conditions within project area recreation residence tracts would be treated to meet project objectives.

Schedule fuel treatments in and adjacent to developed recreation sites to minimize user disturbance: When practical, the timing of fuel reduction operations in and adjacent to recreation sites would be scheduled to avoid periods of peak visitor use, (approximately June 25 to September 15).

Provide environmental education: Public understanding of both the reason for treating fuel conditions in the forest and the logistics of what that treatment means for their recreation access is critical to the overall success of the fuel reduction efforts. Environmental education strategies, messages and materials would be prepared and actively shared to support the project's success through the LTBMU web site, handouts at visitor centers, and sharing information with the media (e.g., newspaper news releases, public announcements on radio and television).

Summary of recreation design features

- Implement temporary area closures to recreation access for areas where activities are in progress.
- Schedule treatments to avoid peak visitor use recreation times in developed recreation areas, when practical.
- Provide environmental education and notification to the public for the project.
- Include fuel treatments on Forest Service lands within and surrounding special use permit properties, and schedule treatment timing to minimize user disturbance.
- Use a combination of signage and physical barriers to discourage post-treatment establishment of user-created routes within treatment areas.

Visual Quality Objectives (VQOs)

- ➢ Modify vegetation structure in a manner that reduces the potential for wildfire to result in the loss of more than 50% of largest trees within a given stand. This change in scenic stability would increase the probability to perpetuate the valued scenic attributes of an openly spaced, forested landscape in the future and would trend toward SNFPA-desired conditions of a "large tree" dominated landscape character.
- ➢ Develop treatment prescriptions consistent with the adopted visual quality objectives identified in the LTBMU Forest Plan.
- ➢ Locate mechanical treatment landing areas beyond sight from major travel routes (e.g., US 50, Highway 89, Pioneer Trail) where feasible.
- ➢ Visually blend staging areas, including landings, temporary roads, or other cleared areas into the surrounding landscape at completion of the project.

Scenic design features to meet visual quality objectives

The proposed fuels reduction project occurs within areas of the Forest that are highly valued by the Forest's visitors and residents. Within the project area, visual quality objectives (VQOs) of Retention and Partial Retention are identified in the Forest Plan. The Retention VQO provides for management activities on National Forest lands that are not visually evident. Under Retention, activities could only repeat form, line, color and textures that are frequently found in the characteristic landscape. The partial retention VQO provides for management activities that remain visually subordinate to the characteristic landscape. Activities under partial retention could repeat form, line, color, or texture common the characteristic landscape, but changes in their qualities of size, amount, intensity, direction, pattern, and duration must remain visually subordinate to the characteristic surrounding landscape.

Supporting mapping of the South Shore landscape analysis identifies scenic classes. Class One landscapes have higher scenic attributes (attractiveness, visibility, etc.) than Class Two landscapes. Both Class One and Two landscapes represent areas of high scenic value.

In order to reduce impacts to the LTBMU scenic resources within the proposed fuels reduction treatment areas, scenic design features would be integrated into the project. Treatment prescriptions would be refined as specific stand condition exams are completed and the opportunities to enhance scenic attributes through changes in forest structure are defined. In general, the more an area is valued for its scenic resource, the more effort would be required to reduce the visual impacts of project activities. For visual quality design features see Appendix E.

Efforts would be taken to ensure that visual evidence of disturbance is reduced as quickly as possible within foreground visibility zones. If air quality standards can be met and burn days are available, hand-piles would be burned within three years of project implementation. Landings and temporary roads would be blended into the surrounding landscape at the completion of the project. Mastication and/or chipping would be one method used to provide cover and reduce evidence of vehicle access and mechanical fuels reduction activities at completion of the project.

Summary of VQO/scenic design features

- Schedule treatments to disperse visual impacts spatially in the landscape and over time.
- Retain up to 15% of existing 4 to10-inch dbh trees and shrubs within foreground view treatment areas; create irregular spacing and clumping distribution between trees and groups of trees within foreground views.
- Clumps of understory vegetation would vary in size from 50 to 2000 square feet based on fuel conditions in consultation with the project landscape architect and fuels specialist.
- Vary distances between retained understory vegetation from 90 to 600 feet based on fuel conditions in consultation with the project landscape architect and fuels specialist.
- Design prescribed surface fires to retain this pattern of selected understory vegetation following biomass removal activities, as well as to reduce evidence of tree scorching within foreground views.
- Retain largest non-hazard tree snags at a rate of three to six per acre where possible.
- Minimize cut stump heights and locate burn piles so as to minimize visibility within foreground views from travel routes.
- Provide cover on landings, temporary roads, or other cleared areas to blend these areas visually into the surrounding landscape at completion of the project.
- Use fuel treatments to increase scenic viewing opportunities where existing fuels concentrations prevent attractive views, e.g., views of meadows, views of Lake Tahoe, and views of aspen.
- Locate mechanical treatment landings beyond foreground views and beyond views from major travel routes (e.g., US 50, Pioneer Trail, and Highway 89) where feasible.

Transportation and Access Objectives

- ➢ Design the transportation system to Forest Service standards to support fuels reduction activities and equipment.
- ➢ Locate temporary roads on existing roadbeds to minimize new ground disturbance where possible.

- Discourage post-treatment establishment of user-created routes within treatment areas.

Background and design to meet transportation objectives

The LTBMU inventoried all roads on National Forest System lands in the summer of 1998. This road network totals approximately 418 miles. Data were collected and used to conduct a risk analysis of each road's potential to affect water quality, with results of this risk analysis documented in a map.

The Lake Tahoe Basin Management Unit developed an access and travel management plan (ATM) for all Forest Service roads in the Lake Tahoe Basin. Implementation of the roads ATM began in 1998, with the goal of producing a transportation system in desired condition. There are 90 miles of system road in the South Shore project area. Although road reconstruction or maintenance would be needed for operability, the fuels reduction project would not add new permanent road mileage to the transportation system. It would be consistent with the road management accomplishments and water quality objectives defined in the ATM and roads analysis report (USDA FS LTBMU 2000).

Most of the South Shore project would be accomplished on the existing permanent road system, with a minor amount of temporary roads. The South Shore project would not require construction of any new permanent roads. Table 2-1 below provides the approximate proportions of road usage for the project.

Table 2-1 – Projected Roads for the South Shore project

Road Type	Percentage of Total Miles Needed
City Streets	4%
County Roads	22%
Forest Service Roads	66%
Temporary/Spur Roads	8%

Preliminary indications are that approximately half of the temporary roads that would be needed for the South Shore project are located on old roadbed prisms of existing temporary roads that would be used. These are likely to need some reconstruction. The reconstruction needs vary between roads, but could include installation of drainage structures to prevent surface water runoff, road widening for vehicle access, and road surface stabilization. The road widening could include removing trees larger than 30 inches dbh.

There are mechanical treatment areas identified in the project area that would require new construction of temporary roads or skid trails. Approximately half of the temporary roads would need to be reconstructed for thinning operations. These areas would require falling and removal of trees creating openings wide enough for vehicle access. This could require removal of trees larger than 30" dbh. All temporary roads would have structures to prevent surface water runoff, and road surface stabilization as needed. Temporary road BMPs would be implemented during and at the completion of the project, as listed in Appendix C. These roads would be closed and stabilized to provide drainage and hydrologic function after project completion. Barriers would be installed at strategic locations after fuel treatments to prevent the development of user created trails that are not a current designated route. Waterbars with adequate energy dissipation or other site-specific drainage structures would be installed to provide proper drainage. Other rehabilitation could include provision of sufficient ground cover or use of a sub-soiler to reduce compaction, and would be implemented as determined by the soil scientist and/or hydrologist.

Road adjacent to meadow and forest

Transportation design features

Roads

- No new permanent roads would be constructed for either action alternative.
- For both action alternatives, approximately 4 miles of City of South Lake Tahoe streets would be used. No improvements or reconstruction would be needed on any of these streets. Encroachment permits would be needed to access these streets from Forest lands. Rocking or stabilization of the Forest Service access road at the intersection with city streets may be required to prevent tracking of debris and soil onto city streets. These intersections would be temporary, and be blocked or obliterated when the project is complete.
- For both action alternatives, approximately 38 miles of El Dorado County roads would be used. Encroachment permits would also be needed where Forest Service roads intersect with County roads. There is potential for some existing intersections to be expanded or improved to accommodate the turning radius for equipment or trucks used for the project.
- All native surfaced roads that intersect onto a paved or stabilized surface would be rocked at the intersection to prevent tracking soils onto the pavement.
- Existing roads would be reconstructed and/or maintained to Forest Service standards that support equipment and trucks needed for project activities. These standards are tailored to protect soil and water quality resources from impacts of the specific equipment classifications to be used for the project activities.
- BMPs for roads (see Appendix C) would be utilized in the reconstruction and maintenance of existing roads used by the project. These BMPs would be implemented for the construction, maintenance and decommissioning of temporary roads during and at the conclusion of project activities. These BMPs would guide the design engineer, construction inspector, and contracting officer in the design, reconstruction, maintenance, and management of each road. Monitoring of these BMP precautions throughout the life of the project and/or until soils have been stabilized is found in Chapter 4.

- Existing roads would be cleared to allow one-way passage for equipment and trucks, but would not be cleared beyond the original road prism. In general, temporary roads would not have constructed turnouts to accommodate two-way traffic. By using radio traffic control, in-coming traffic would wait for the out-going traffic at a predetermined location prior to proceeding to the landing in use.

- When a temporary road would use the alignment of a previously decommissioned road, the following reconstruction activities would take place.
    - Vegetation removal: Light brush, small trees, and grasses would usually be removed by equipment such a dozers or graders. Lager trees and brush would require hand removal and piling for disposal.
    - Grading: Obstacles such as ruts, water bars, leadoff ditches, and pronounced dips would be graded out to make the road suitable for logging traffic.
    - Drainage: Facilities such as culverts or fords would be installed to accommodate the free flow of drainages and ditches. Dips and leadoff ditches would be installed to facilitate occasional thunderstorm runoff.

- New temporary roads would be out-sloped to ensure that effective drainage is maintained.

- The majority of roads that would be reconstructed are located on gentle side slopes with cuts and fill less than 3 feet. There are two roads that exceed these cut and fill heights, and in both cases, the existing slopes would not be disturbed. The Powerline road (12N08) would require a culvert improvement with additional fill.

- Temporary crossings on intermittent and ephemeral drainages would be constructed and removed when the channels are dry (BMP#2-16) and would be installed such that water flow and fish passage would not be obstructed.

- Ephemeral channel crossings would be removed prior to any National Weather Service forecasted large precipitation event and before the winter season begins.

- For a temporary crossing on an intermittent channel in the Saxon Creek watershed that would be used in consecutive years, the crossing would be constructed to remain in place over the winter without adverse effects to water quality or the stream channel. Construction would use a filter fabric on the bottom; with a culvert installed over the fabric of sufficient size to pass the winter and spring flows without causing accelerated flow downstream (approximately 18-24” diameter); rock would be used instead of dirt to fill in behind the culvert.

- The permanent stream crossing on Forest Service system road 12N01A over a tributary to Saxon Creek would be replaced and improved in the fall, when the channel is not flowing. The existing low-water crossing is a flood barrier that is causing erosion immediately downstream and aggradation upstream. A new channel crossing would span the entire width of the floodplain and would be designed to pass a 100-year flood event. Possible designs would be evaluated for reducing installation disturbance to the floodplain. Designs include 1) a series of pre-fabricated bridge segments with gabion basket supports filled with small boulders permeable to water flow, and 2) a series of five arched culverts surrounded by the gabion baskets, with the center culvert large enough to pass the bank-full water volume. Excavation in the flood plain would be required to remove the existing fill and connect the foundation of the road with the crossing to support equipment and hauling trucks. The removed fill would be replaced with granular material to support the weight of the crossing and the intended use. Installation would occur when the channel and meadow are relatively dry; dewatering and diversions are not expected to be necessary. If groundwater is intercepted during construction, it would be pumped to adjacent upland areas.

- A crushed culvert on Forest Service system road 12N20 in the Osgood Swamp watershed would be removed, and the crossing over the spring-fed perennial stream would be improved. The existing crossing is too narrow for ground-based equipment to cross without potential resource damage. The crossing would be designed to pass the 100-year flood water volume of the channel and allow unobstructed fish passage. An objective for this crossing is the maintenance of a natural stream bottom, with possible designs including a bottomless arched culvert, a prefabricated steel span, or a prefabricated concrete “box” culvert with the underside buried under the natural stream bottom. Because this channel is spring fed, it flows perennially and would need to be dewatered with the flow diverted around the site during culvert replacement. First, a diversion channel would be created adjacent to the channel and lined with a synthetic material to avoid direct contact with the ground. Second, coffer dams would be installed at the upstream and downstream ends of the crossing. When the water backs up sufficiently behind the upper coffer dam, it will flow with gravity around the crossing to the stream reach immediately downstream of the lower coffer dam. Any remaining water in the crossing replacement area and intercepted ground water would be pumped to nearby upland areas. Pumps would be kept onsite throughout crossing installation to maintain a water free construction zone. Once the construction area is free of standing water, the existing culvert and unsuitable materials (i.e. organic soil) would be removed, and the new crossing would be installed with its footings extending below the existing channel to allow for a natural material bed. Lastly, fill would be placed around and over the new culvert to connect the existing road surface elevation with the culvert crossing. Prior to allowing the channel flow back into the downstream reach after crossing installation, water would be pumped to upland areas until water quality is acceptable for discharge into the channel.
- Existing and new temporary roads would be decommissioned after use, which would involve providing ground cover such as slash, wood chip or masticated material (to a maximum six-inch depth) and installing water bars as appropriate to prevent accumulating water on the road surface.
- As part of decommissioning, temporary roads would be ripped and seeded where the rock content of the soil allows, as determined by the sale administrator (BMP#1-17 and 2-26).
- Drainage would be restored during decommissioning by removing all culverts and/or fords. Water bars, dips, and leadoff ditches would be re-established.
- Barriers would be strategically established along open areas adjacent to road or trail access (boulders, split rail fence, and barriers/signs) to discourage post-treatment establishment of user-created routes that are not designated routes. In addition, natural barriers such as large logs and rocks would be placed where necessary at road entrance points to prevent continued use of decommissioned road alignment.
- Skid trails would be closed and stabilized after fuel reduction activities to provide drainage and hydrologic function (see Water and Soils Resources sections).

Roads (outside of normal operating period)

- Unless adequate snow cover or frozen soil conditions exist, where a native surface road meets a paved road, the road intersection must be covered with rock or organic material to prevent tracking of mud onto the paved road.

- If a native surface road becomes rutted, the road would be closed unless spot-rocking or other mitigation of rutted areas will be effective in preventing road damage. Rutting is defined as two-inch deep depressions, over 10% or more of the road surface, on a per mile basis.
- Rutting of a road, forwarder trail, or any other disturbance that can deliver sediment into a water body or SEZ must be avoided.
- During winter operations, paved surfaced roads may be plowed, including turnouts, if the action will not cause damage to the road surface and associated drainage structures.
- On native surface roads, a minimum of 6 inches of compacted snow would be retaind on 85% or more of the road surface after plowing to facilitate freezing. During road use, a minimum of 6 inches of compacted snow must be present on 85% or more of the road surface, unless the road surface is frozen to a depth of 3 inches or more. Ensure that plowing does not damage drainage structures.
- Road alignments within the contract area that require snow removal shall be visibly marked on both sides along the entire alignment to facilitate plowing. Excess snow removed during plowing shall not be placed into drainages or riparian areas.
- Before over-the-snow operations begin, existing culvert locations would be marked. During and after operations, ensure that all culverts and ditches are open and functional.
- When roads are plowed, snow berms must be breached to allow drainage during snowmelt. Space outlets so as not to concentrate road surface flows (usually spaced at a minimum of every 300 feet). Erosion control structures may be necessary at outlets to collect road generated sediment, and will be agreed to by the sale administrator and watershed specialist.

Landings

- All reasonable effort would be made to use existing landings where available. Where no existing landings are available new landings would be constructed. New landings would be no larger than required in order to safely facilitate the handling and removal of biomass material in compliance with OSHA requirements. Landings would average less than one acre in size and the maximum size would be two acres.
- Prohibit landings, fuel storage, and refueling in SEZs (BMP #1-12).
- Prohibit landings in RCAs unless no feasible alternative exists. Allow refueling in RCAs only if no feasible alternative exists, if a spill occurs follow BMP 2-12 procedures.
- Provide proper drainage from landings; ditching or sloping may be used where needed. (BMP #1-16).
- Decommission landings after operations are complete in each area using the following methods:
- Apply wood chip or masticated material to each landing to a maximum depth of 6 inches (BMP #1-15).
- After chipping or mastication, rip the landing to approximately a 12-inch depth, and seed the area with a native seed mix of grasses, forbs, and shrubs (BMP #1-15). Ripping may not be possible in very rocky soils; this determination may be made by the sale administrator.
- Landings located within RCAs, and those that are greater than ¼ acre in size shall be priorities for decommissioning if the soil rock content allows.

- Construction of landings could require removal of trees larger than 30” dbh, but this situation would be minimized through the choice for location of the landing, since the overall objective is to reduce fuels by thinning out smaller trees and retaining the large trees.

Summary of transportation design features

- Maintain and/or restore roads to Forest Service standards that support equipment and trucks needed for activities. These standards are tailored to protect soil and water quality resources from the impacts of specific classifications of equipment use.
- Close and stabilize temporary roads and skid trails after fuel reduction activities to provide drainage and hydrologic function.
- Implement road BMPs during and at the conclusion of project activities.
- Strategically establish barriers along open areas adjacent to road or trail access (boulders, large logs, split rail fence, and barriers/signs) to prevent user-created trails that are not designated routes.

Heritage Resource Objectives

- ➢ Reduce the risk of negative wildfire effects to cultural resources.
- ➢ Protect cultural resources during treatment activities.
- ➢ Protect arborglyphs in aspen stands while reducing wildfire hazards and conifer competition.

Heritage resource design features

Treatment of fuels adjacent to and within prehistoric and historic site boundaries is desirable to reduce the risk from the effects of high intensity wildfire provided the treatments do not have an adverse effect to the sites. This project would utilize the protection and stipulation measures outlined in the Pacific Southwest Region Programmatic Agreement with the California State Historic Preservation Officer and the Advisory Council on Historic Preservation (2001) to protect and perform fuels treatment within site boundaries in hand thinning units. These same measures would be used to perform hand treatments within site boundaries in mechanical treatment units. This is expected to provide a uniform treatment of the area and would avoid untreated islands of hazardous fuels within prehistoric or historic resource sites.

Linear prehistoric and historic sites are a potential barrier to treatment within mechanical treatment units. Wherever possible, integrity data would be collected for linear sites during the inventory and recording phase along with data on pre-existing breaches in the linear sites to facilitate evaluation of the sites for eligibility to the National Register of Historic Places and identification of locations where equipment may be able to cross these features.

The risk of loss of aspen stands with historic arborglyphs would be reduced by treatments that remove invading conifer. Hand treatment and piling outside the stand would reduce fuel hazards and reduce conifer competition in these stands to increase the life and health of the trees that contain these arborglyphs. Low-intensity fire through the stands could be considered if the arborglyphs can be protected from the flames.

Summary of heritage resource design features

- Flag and avoid mechanical equipment within discrete sites.
- Use hand treatments to reduce wildfire effects within heritage sites.

- Evaluate linear features to establish possible crossing areas.
- Reduce conifer invasion in aspen stands.
- Protect arborglyphs during prescribed fire.

Aspen grove

Alternative 3

Alternative 3 is a modification of the proposed action (Alternative 2) in response to public and agency comments received during scoping. It responds to the issues of watershed impacts, impacts to sensitive species, and impacts of temporary road construction and reconstruction. In order to reduce redundant text and highlight the differences between these two action alternatives, only the changes from the proposed action will be discussed for Alternative 3. The purposes and needs for action remain the same as the proposed action.

The treatment methods remain the same as the proposed action, but there are some additional design features as well as changes in the acreage for application of those treatments based on field review, data review, and fire behavior modeling of areas proposed for treatment in the project. The objective for development of Alternative 3 is to respond to public and agency comments to reduce environmental impacts while meeting the needs and achieving the purposes identified for the project in Chapter 1: 1) reducing hazardous fuels in the WUI, 2) improving the health of the conifer forest within the project area, and 3) removing conifer encroachment to improve meadows and aspen stands.

Watershed Impacts Issue

Changes to treatment types to reduce watershed impacts were based on the following criteria:

- Where the 2007 - 2008 field review of the SEZ characteristics such as soil type, soil moisture, slope, and condition of stream channels in RCAs and streamside SEZs determined that an SEZ was more sensitive than Heavenly Valley Creek SEZ demonstration project based on the LTBMU SEZ sensitivity rating system, they would not be treated with ground based equipment in order to reduce impacts to SEZs.
- Where the use of mechanical equipment for removal of larger material is required to meet fuel reduction objectives, and SEZ characteristics were similar to or less sensitive than the Heavenly Valley Creek SEZ demonstration project based on the LTBMU SEZ sensitivity rating system, mechanical treatments could continue.
- SEZ mechanical treatment units were also evaluated for the diameter of trees to be removed to determine whether fuels reduction, aspen stand restoration, and riparian vegetation restoration objectives could be safely achieved by hand crews (14” dbh for live trees and 20” dbh for dead).
- Soil type and erosion hazard ratings were verified by field surveys during the summers of 2007 and 2008, and treatment methods were adjusted where needed.
- Where the 2007 – 2008 field review found terrain limitations due to inclusions of steeper slopes or extensive rock, treatments were changed from whole tree to CTL, or from CTL to hand treatment.

Field surveys and results

Field surveys to evaluate stands for SEZ sensitivity using the above rating system were completed during September through November, 2007, and continued through the field season of 2008. Based on a review of GIS maps and knowledge of the characteristics of the project area, 143 stands proposed for CTL mechanical treatment were identified as containing more than 0.05 acres of SEZ, and prioritized for field evaluation. During these field visits, South Shore stands that are proposed for CTL mechanical treatment and contain SEZs were rated for their level of sensitivity to mechanical equipment operations. At the time of field visits, the current condition of the water and soil resources was determined to evaluate the potential effects from proposed vegetation management activities. Approximately 70% of the CTL treatment stands containing SEZs (100 total) have been evaluated and rated for their level of sensitivity.

Based on this field work, only 7 of the 100 stands rated were found to be more sensitive than the demonstration project area along Heavenly Valley Creek (HSEZ). Due to the greater level of sensitivity than HSEZ, all or part of these stands would be treated with hand crews instead of ground based equipment. Where only a portion of the SEZ stands were responsible for the high sensitivity rating, those sensitive portions would be changed to hand treatment. To avoid splitting stands into small fragments, these stands are still included as being treated mechanically, however the more sensitive portions have been identified, and would be hand treated instead. The wet soil or sensitive areas would be flagged for hand treatment prior to mechanical operations in the remaining areas.

Eight stands were rated as being equally sensitive to the HSEZ site, which represent an acceptable level of sensitivity and associated risk of impacts, and planning for mechanical treatment of these stands would continue.

Approximately 43 additional stands contain SEZs proposed for mechanical treatment that have not been visited or rated for sensitivity. These stands would be rated by a hydrologist or soil scientist prior to implementation to ensure that the level of sensitivity of each stand is equal to or less than the HSEZ site. If additional stands are found to be more sensitive than the HSEZ site, the treatment type in all or part of those stands would also be changed to hand thinning.

Impacts to Sensitive Wildlife Habitat Issue

Changes to treatments aimed at reducing impacts to sensitive species and their habitats were proposed based on the following: spatial extent of northern goshawk and California spotted owl PACs, proximity of treatments to known goshawk nest sites, WUI zone (defense or threat), type of treatment proposed (mechanical or hand), stand survey data, and type of fire behavior predicted (using FARSITE, FLAMMAP, and FVS models). (Changes would also follow management direction from the SNFPA and TRPA Code of Ordinances for wildlife resources.)

- In the WUI defense zone, LTBMU evaluated proposed treatments within spotted owl and goshawk PACs based on stand survey data and stand-by-stand predicted fire behavior within each PAC.
    - Where a crown fire (conditional, passive, or active) was predicted for a stand, the level of treatments necessary for fuel reduction under the PAC prescription detailed in Alternative 2 was retained.
    - Where a surface fire was predicted, the portion of stand within the PAC was eliminated from further consideration for treatment. Surrounding stand treatments were not changed; PAC boundaries were not adjusted.
- In the WUI Threat Zone, LTBMU evaluated proposed treatments within spotted owl and goshawks PACs based on the feasibility of implementing prescribed fire, stand survey data and predicted fire behavior at the landscape level.
    - Where the overall landscape fire and fuels strategy would be compromised, the level of treatments necessary for fuel reduction under the PAC prescription detailed in Alternative 2 were retained.
    - Where fire behavior modeling indicated the landscape fire to be a surface fire, all portions of that stand within the PAC were eliminated from further consideration for treatment. Surrounding stand treatments were not changed; PAC boundaries were not adjusted.
- If stands within PACs would receive mechanical fuel treatments, acreage equivalent (in quality and quantity) to the acres of mechanical treatment were added to the PAC following SNFPA standards and guidelines. This requirement applies only to PACs. In some cases, where the area added to the PAC also requires mechanical fuel reduction treatment, the net result is a increase in the acres mechanically treated within PACs. If stands within PACs would receive hand treatments, no adjustments are required.
- Proposed treatments within the TRPA disturbance zone for northern goshawk (0.5 mile radius of a known nest) were modified to meet non-degradation standards for this species habitat. Some stand boundaries were modified to meet this standard.
- Review of the suitable habitat available for other sensitive species, such as osprey and bald eagle, resulted in an incidental reduction of treatments in habitat acres as detailed in the alternative comparison section below. Some of these changes were the result of overlap with PAC habitat for California spotted owls or goshawks, overlap with other resources such as sensitive plants, or changes to SEZ treatments.
- The number of PACs, HRCAs, and TRPA disturbance zones within the project analysis area remain the same for both action alternatives; there are 16 northern goshawk PACs and nine California spotted owl PACs/HRCAs in the project analysis area. However, Alternative 3 reduces the number of both goshawk and spotted owl PACs that would be treated compared to Alternative 2.

- The resulting changes in treatment type acres are included in the alternative comparison section below, see Table 2-4.

Temporary Road Construction and Reconstruction Issue

Alternative 3 reduces impacts from road construction based on the following:

- A low-water crossing on a Saxon Creek tributary would be replaced by a low-profile series of culverts. The center squash culvert would convey, without accelerating, the 2-3 year storm event. The additional culverts spread across the stream profile are designed to collectively pass the 100-year storm without over-topping. The water levels of this tributary do not currently provide adequate fish habitat, therefore fish passage is not an issue. The proposed wire fence gabion structure is designed as structure for the road bed, but has some benefit of itself being water permeable unless the void spaces become filled with sediment. Construction of the gabions would follow construction specifications to ensure the edges are stacked with vertical rock faces to avoid "saggy" edges. This is a feature for long-term durability of the material as well as visual appearance. This bridge would reduce current sedimentation from the existing low-water crossing and would allow road access for future forest management and fire suppression needs. The bridge also reduces the need for temporary roads by 0.7 mile.
- Temporary roads would not be constructed to access units that have changed from mechanical to hand treatments under alternative 3 to respond to watershed, soils, or wildlife issues.
- In cases where road construction costs or environmental impacts could be avoided and the unit objectives could be accomplished with hand treatments, the road was eliminated from Alternative 3.
- The number of landings also decreased for the same reasons as the decrease in roads.
- The resulting changes in treatment type acres are included in the alternative comparison section below, see Table 2-5.

Comparison of Treatment Changes Alternatives 2 and 3:

This section summarizes and provides a comparison of the changes from all design modifications from Alternative 2 to Alternative 3. The following tables disclose the acreage changes between the treatment types as well as the overall decrease in acres proposed for treatment between Alternatives 2 and 3. Table 2-2 details the differences in types of treatment, and Table 2-3 shows the differences in fuel treatments. Table 2-4 gives the changes that respond to the wildlife habitat issue, and Table 2-5 reflects how the other changes affect roads and landings needs under each alternative. Table 2-6 shows the resulting changes that occur for IRAs.

Table 2-2. Changes in treatment types for SEZ and upland areas by alternative

Thinning Treatment Type	Alternative 2 Acres	Alternative 3 Acres	Difference Acres
Hand Treatment SEZ	87	138	51
Hand Treatment outside SEZs	4855	5849	994
Total Hand Treatment	4942	5987	1045
Cut to Length SEZ	447	385	-62
CTL outside SEZ	1463	1625	162
Total Cut-to-Length	1910	2010	100
Whole Tree SEZ	198	170	-28
WT outside SEZ	3620	1971	-1649
Total Whole Tree	3818	2141	-1677
Total SEZ treatment	732	693	-39
Total outside SEZ	9938	9445	-493
Total treatment	10670	10138	-532

Table 2-2 acres are additive. However, Table 2-3 acres for fuel treatments (below) are not additive, partly due to the type of vegetative treatment, and partly due to the need for more than one type of fuel treatments in some units. The whole tree treatment method would remove trees and fuel to the landing area, and removal (e.g., for biomass) or burning would occur on the much smaller acreage of the landings rather than throughout the treatment unit. An example of multiple fuel treatments would be when desired fuel loads could not be attained through burning hand piles and under-burning is needed as a follow-up treatment to reduce fuel loads to the desired levels. Table 2-3 acreage could vary as fuel loading is evaluated after the initial vegetation treatment is completed.

Table 2-3. Comparison of fuel treatment type acres by alternative

Fuel Treatment Type	Alternative 2 Acres	Alternative 3 Acres	Differences Acres
Landing Pile Burning or Removal	128	77	-51
Chipping or Masticating	2480	2617	137
Hand Pile and Burn	4372	5217	845
Under-burning	850	774	-76
Whole Tree Forwarding (SEZs)	447	385	-62
Hand Removal (SEZs)	87	138	51
Lop and Scatter (SEZs)	198	170	-28
Under-burning (SEZs)	32	28	-4

Table 2-4 acres are not additive because there is complexity in the overlap of habitat use among the various species. For example, California spotted owls and northern goshawks share many of the same vegetative requirements in their preferred habitats, and often nest in closer proximity to each other than to another pair of their own species, which creates an overlap in their PACs. Also, each PAC is made up of several vegetative stands, with fire behavior modeling for each of the vegetation stands within the PACs for Alternative 3. Therefore, an individual vegetation stand could be part of a single PAC, two PACs (an owl and a goshawk), or combined with other sensitive species habitat areas.

Table 2-4. Comparison of wildlife treatment acres by alternative*

Sensitive Species & Habitat	Alternative 2	Alternative 3	Change
Number of CA spotted owl PACs treated	6	5	-1
Acres of CA spotted owl PACs treated	849	611	-238
Number of CA spotted owl HRCAs treated	7	7	0
Acres of CA spotted owl HRCAs treated	3001	2559	-442
Number of goshawk PACs treated	9	7	-2
Acres of goshawk PACs treated	1319	967	-352
Acres treated within goshawk TRPA Disturbance Zone	1924	1623	-301
Acres treated within bald eagle winter habitat	162	154	-8
Acres treated within osprey TRPA disturbance zone	1068	1041	-27

*Due to spatial overlap, change in acres is not additive

Both the use of existing roads and the need for new temporary roads were reduced for Alternative 3 in response to the changes in treatment methods. Reconstruction of the crossing on a Saxon creek tributary eliminated the need for a temporary road to access that area, while avoidance of a cultural resource site necessitated construction of one-half mile of new temporary road in the action alternatives.

Table 2-5. Decrease in proposed road construction and landings between Alternatives 2 and 3

	Alternative 2	Alternative 3	Decrease
New temporary roads	25,336 feet	20,222 feet	- 5,114 feet
Existing temp roads	54,145 feet	45,158 feet	- 8,987 feet
Number of Landings	222 landings	172 landings	-50 landings

Neither action alternative proposed treatments in currently unroaded portions (1B) of any IRA. However, due to the reductions and changes in treatment acres to address other issues, changes and reductions of treatments within currently roaded portions (1C) of IRAs within the South Shore project area also occurred.

Table 2-6. Inventoried Roadless categories and activity acres

IRA Name	Category	Treatment	Alternative 2 Acres	Alternative 3 Acres	Change
Dardanelles	1B	None	13,932	13,932	0
	1C	None	47	75	28
	1C	Hand Treatment	222	194	-28
	1C	Mechanical	9	8	-1
Freel	1B	None	14,894	14,894	0
	1C	None	283	298	15
	1C	Hand Treatment	151	136	-15
	1C	Mechanical	0.3	0	-0.3
Pyramid	1B	None	3,356	3,356	0
	1C	None	103	103	0
	1C	Hand Treatment	215	227	12
	1C	Mechanical	49	37	-12

Design Criteria Comparison for Action Alternatives

The Forest Service developed design criteria to be used for the proposed action (Alternative 2), and developed additional design criteria specifically to reduce environmental impacts in response to the issues for Alternative 3. Differences in acreages between the action alternatives result mainly from the differences in the areas and types of treatments between Alternatives 2 and 3. Differences in effects between the action alternatives result both from the additional design criteria and the changes in type and area of treatments. All treatment methods are mitigated through the design criteria to reduce negative effects to the human environment.

Alternative 3 Changes That Mitigate Environmental Effects under CEQA

There is a net decrease of 532 acres in total treatments under Alternative 3. In addition, treatment methods change to methods with less potential for negative environmental effects on over 1,000 acres. There are three combinations of treatment method changes: 1) from whole-tree (WT) methods to cut-to-length methods, hand treatments, or no treatment; 2) from CTL to hand treatment or no treatment, and 3) hand treatment to no treatment. The net effect of this combination of changes is a reduction of 1,677 acres from WT methods, an increase of 100 acres in CTL methods, and an increase of 1,045 acres in hand treatments.

Within SEZs, there are the same combinations of treatment method changes: 1) from whole tree methods to CTL methods, hand treatments, or no treatment; 2) from CTL to hand treatment or no treatment, and 3) hand treatment to no treatment. The net effect of this combination of changes is a reduction of 30 acres of SEZ in WT methods, a reduction of 41 acres in SEZ cut-to-length methods, an increase of 25 acres in SEZ hand treatments, and a net decrease of 41 acres in total SEZ treatments.

Mechanical treatment types are divided into WT or CTL methods for effects analysis, based on equipment currently available. However, methods and equipment are constantly evolving, and if equipment with lower environmental impacts becomes available during the life of the project, it could be used to further mitigate negative environmental effects.

One less California spotted owl PACs and two fewer northern goshawk PACs would be disturbed by fuel treatment activities in Alternative 3. Because many wildlife species share habitat areas, acreage reduction in affected habitat is only relevant by individual species, and is not additive. The reduction in habitat acreage affected by Alternative 3 discloses the effective mitigation by individual species in Table 2-4 above.

An additional mitigation included in Alternative 3 is a reduction in the mileage of roads and landings needed due to the changes in treatments identified above. Approximately one mile of new temporary roads would be eliminated, and approximately 1.7 miles of existing roads would not be used under Alternative 3. Some of these existing roads are currently closed and some are currently converted to trails. These would not be re-opened for equipment use under Alternative 3, which would mitigate effects of the project by reducing disturbance associated with road reconstruction.

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:

- In response to public comments received during scoping, an alternative was considered with no mechanical equipment is SEZs. This alternative was dropped from further consideration because:
  - Prohibition of mechanical equipment in SEZs would not meet the need to reduce hazardous fuels to change fire behavior and provide a defense zone for neighborhoods and communities. Without mechanical equipment, trees over 14” dbh could not be removed due to the safety limitations for hand treatments. There is the potential that some SEZs would not have fuel reduction treatments due to diameter limits.
  - Without mechanical equipment allowed in SEZs it would not be feasible to move fuel outside the SEZ area for burning or biomass utilization. The usual operations for hand thinning includes burning the piles of thinned material, which would decrease the opportunities for biomass use of the material and increase the smoke generation from burning the hand-thinned piles.
  - In order to meet the purpose to promote dominance of riparian vegetation, there is a need to remove conifer invasion in aspen stands that are within SEZs, and some trees larger than 14” dbh need to be removed. Prohibition of mechanical equipment in SEZs would prevent achievement of healthy riparian vegetative conditions where aspen, willow, and other riparian vegetation dominate in SEZs.
  - To address public comments, Alternative 3, detailed in Chapter 2 of this EIS/EIR was designed to reduce activities and impacts in SEZs.

- In response to public comments received during scoping, an alternative was considered to use only CTL equipment for thinning trees in the mechanical treatment areas of the project. This alternative was dropped from further consideration because:
  - Limiting mechanical equipment to CTL methods outside of SEZs would lengthen the implementation time to such an extent that the project would not provide the fuel reduction needed for communities in a timely manner. CTL operations in the central Sierra Nevada are limited. About 500 acres per year has been the maximum production level for CTL tree thinning in the Lake Tahoe Basin. The average production has been 350 acres per year, which would extend implementation of the South Shore project over a period ranging from 12 to 17 years. This extended time of implementation would fail to reduce hazardous fuel levels for communities and homes adjacent to the National Forest in a timely manner. Due to the limitations of CTL systems, whole tree or conventional equipment is more efficient at removing biomass.
  - This alternative would also not allow for the use of any other innovative technology thinning equipment with equivalent or reduced environmental effects.

- In response to public comments received during scoping, an alternative was considered with no fuel reduction activities within spotted owl or goshawk PACs or TRPA goshawk disturbance zones, osprey, or bald eagle habitats. This alternative was dropped from further consideration because:
  - To provide no treatments to reduce fuels on almost 3,700 acres within the WUI defense zone would leave hazardous fuels adjacent to homes and communities on over 30% of the area identified as needing fuel reduction that is included in the South Shore project. Approximately 750 California spotted owl PAC acres, 1,525 goshawk PAC acres, 500 acres of TRPA goshawk disturbance zone acres, 750 acres of osprey habitat, and 165 acres of bald eagle wintering habitat in the South Shore project area lie within the WUI defense zone. Reduction of hazardous fuels is identified as a need for this project in

order to meet the purpose of changing fire behavior to reduce the risk to lives and property from wildfire. This alternative would fail to meet that purpose and need.
- To address public comments, Alternative 3, detailed in Chapter 2 of this EIS, was designed to treat sensitive wildlife habitats only if a stand-by-stand analysis predicted wildfire behavior as a crown fire in the WUI defense zone, or if landscape level wildfire analysis indicated that fuel treatment effectiveness would be compromised in the WUI threat zone without fuel reduction in the PAC. This means that habitat where the models predicted surface fire would not receive fuel treatment under Alternative 3.

♦ In response to public comments received during scoping, an alternative was considered that aggregated treatment areas to improve operative efficiency with less movement of equipment among fuel reduction areas. This alternative was dropped from further consideration because:

- While this alternative is the least costly from an economical operations standpoint, it has higher negative impacts to watersheds. This alternative would cause most of the HUC7 watersheds within the project analysis area to exceed 100% of their threshold of concern. This alternative would cause unnecessary risk for environmental harm and fails to meet the purpose of minimizing effects to watersheds and protecting water quality.
- This alternative would also not meet the need to provide alternate refuge habitat for sensitive species when fuel reduction activities were scheduled in their habitat areas, which would increase the potential for negative impacts to sensitive species.
- This alternative would also have greater short-term impacts to scenic quality by concentrating activities within view areas.

♦ Public comments received during scoping indicated a concern for removal of trees that exceeded various diameter limits; 12”, 14”, 20”, 24”, and 30” dbh. It was stated in the comments that no trees greater than 12” dbh need to be removed in order to meet fuel reduction objectives. One request was that thinning needs be analyzed by two-inch diameter increments on a stand-by-stand basis to determine the diameter classes needing removal to achieve fuels objectives. An alternative was designed to respond to these comments and limit tree removal to 12” dbh or less. This alternative was dropped from further consideration for several reasons:

- While there are some stands in the South Shore project where the trees identified for removal would not exceed 12”dbh, in other stands a 12” diameter limit would prevent meeting the needs and purposes for the project. Removal of the smaller diameter trees first, proceeding by size classes to increasing diameters to meet the purpose and need to reduce fuels and stand density is known as understory thinning, and is basic to the design of the South Shore project. The selection of trees to be thinned in the South Shore project action alternatives would begin with the smallest trees (suppressed and intermediate trees) and continue to remove trees of increasing diameter until the desired stocking level is reached. The desired stocking level is between 100-150 square feet of basal area per acre. In some situations larger trees up to 30” in diameter would need to be removed to meet this target stocking level. This stocking level represents the density at which any higher stand densities would increase the probably of insect attacks (point of imminent mortality). In most stands within the South Shore project few trees near 30” diameter would need removal to meet the desired stocking level. Understory thinning is part of the project design for both of the action alternatives, the proposed action (Alternative 2) and Alternative 3. Another alternative to address this would be repetitive.
- Using dbh as the decision criteria for removal of trees would not meet the long-term purpose of improving forest health in addition to hazardous fuels reduction. The need to reduce basal area and increase spacing between trees to reduce competition for light, water, and soil nutrients in order to reduce mortality and increase resistance to drought,

insects, and disease would not be met. Overly dense forest stands often suffer stress from drought and competition for nutrients, which subjects them to widespread forest dieback from insects and diseases. Removal of trees larger than 16” and less than 30” dbh would be necessary in some units of the South Shore project area to accomplish this purpose.

- o The use of diameter limits would prevent use of some existing openings as landings, which would lead to additional disturbance to create new landings where diameter limits would allow.
- o In order to implement effective removal of conifer encroachment in meadows and aspen stands, some conifers with dbh exceeding 12” need to be removed. Along some SEZs, some conifers over 12” dbh need to be removed in order to meet the purpose of allowing riparian vegetation to become dominant.
- o The mix of conifer species present in the South Shore area now are not at desired conditions nor do they represent the historic diversity present before the Comstock logging era. Logging during the Comstock era selectively removed Jeffery and sugar pine from the LTMBU and left a preponderance of less fire-resistant and less drought-tolerant white fir and lodgepole pine. One of the purposes of the South Shore project is to attain desired conditions of larger, widely spaced, more fire-resistant trees. There is an identified need to reverse this historically created species distribution through retention of Jeffrey/Ponderosa and sugar pine and removal of white fir. In order to meet this need, various diameters of white fir need to be removed, including trees over 12” dbh. Therefore, this alternative fails to meet the restoration of species diversity purpose for the project.

♦ In response to public comments received during scoping, an alternative was considered that would eliminate treatments further than one and one-half miles from year-round residences, i.e., treatments would not occur along Highway 89 or the paved road to Fountain Place. This alternative was dropped from further consideration because:

- o Highway 89 was identified as an essential egress route by the Fallen Leaf and Lake Valley Fire Protection Districts, South Lake Tahoe Fire Departments, and the community wildfire protection plans (CWPPs). The HFRA requires that projects accomplished under HFRA authority be consistent with the CWPPS. Elimination of modification of hazardous fuels along Highway 88 would fail to be consistent with the CWPPs and fail to meet the need for modifying wildfire behavior along an identified egress route.
- o The area surrounding the paved road to Fountain Place receives heavy recreation use, similar to other areas included for treatment within the defense zone. With the adjacent private property and the intensity of recreation use, the risk of fire starts is considered to be very high. In addition, the 2006 fireshed analysis (USDA FS LTBMU, unpub) showed that the area between private lands in Fountain Place and the City of South Lake Tahoe would exhibit crown fire behavior similar to the recent Angora fire, and, with prevailing southwest winds, untreated lands would present a high risk to homes and neighborhoods in South Lake Tahoe. Failure to reduce hazardous fuels and modify fire behavior in this area would not meet the purpose to reduce risk to life and property in that area of the Lake Tahoe Basin.

♦ In response to public comments received during scoping, an alternative was considered that would schedule thinning treatments and stream channel restoration activities at the same time so that impacts of project activities occur in one entry. This alternative was dropped from further consideration because:

- o This alternative would concentrate the effects of both activities in SEZs into a shorter timeframe, without allowing watershed recovery time between thinning activities and ground disturbance for stream restoration activities. This concentration of activities in a shorter time could increase the negative effects to a greater degree than the additive effects of the separate activities when spaced over time.

- Stream restoration projects are a successful ongoing program within the Lake Tahoe Basin, and would be able to continue successfully without becoming part of the South Shore project.
- Stream restoration activities are outside the HFRA authorization, and are not included in the purpose and need for fuels reduction and thinning to promote healthy forest vegetative conditions.

♦ In response to public comments received during scoping, an alternative was considered that would treat only stands where fire behavior modeling for individual stands showed the stand would exhibit crown fire behavior. This alternative was dropped from further consideration because:

- This alternative does not meet the Forest Plan direction as amended by the SNFPA for providing fuel treatments that are effective within the WUI and on a landscape level. The WUI is made up of many different stands of trees, with a wide variety of fuel conditions in close proximity to each other. Wildfire behavior is not only dependent on the individual stand condition; it is also dependent on the conditions within and adjacent to stands. While an individual stand could model as a surface fire if it were isolated, when adjacent to other stands that exhibit crown fire behavior, it could support a conditional crown fire.
- In addition, stands without hazardous fuels, and where spacing and basal area indicate healthy forest conditions are not included in South Shore treatment alternatives.

♦ In response to public comments received during scoping, an alternative was considered that would implement direction in the 2001 SNFPA. This alternative would have a maximum 20" dbh limit for tree removal. The 2001 SNPA also requires leaving 10% to 20% of all stands that are treated to reduce hazardous fuels in an untreated condition. This alternative was dropped from further consideration because:

- Stands of trees with hazardous fuels in the WUI defense zone are of various acreages, and the requirement to retain untreated portions of these stands, which are in proximity to each other, would reduce the effectiveness of the fuel reduction treatments to varying degrees. These untreated areas often exhibit active crown fire behavior and overwhelm the adjacent treated areas of the stands. The result is more unpredictable wildfire behavior that does not meet the purpose to provide a defense zone for homes and communities, and increases the risk to fire suppression personnel.
- One of the purposes of the South Shore project is to attain desired conditions of larger, widely spaced, more fire-resistant trees. There is an identified need to reverse the historic selective removal of pine species by retention of Jeffrey/Ponderosa and sugar pine and removal of white fir. In order to meet this need, various diameters of white fir need to be removed, including trees over 20" dbh. Therefore, this alternative fails to meet the restoration of species diversity purpose for the project.
- The use of diameter limits would prevent use of some existing openings as landings, which would lead to additional disturbance to create new landings where diameter limits would allow. Basal area and spacing of trees to meet the purpose of reducing the risk of insects and disease and increasing drought tolerance would also not be met.
- In order to implement effective removal of conifer encroachment in meadows and aspen stands, some conifers with dbh exceeding 20" need to be removed. Along some SEZs, some conifers over 20" dbh need to be removed in order to allow riparian vegetation to become dominant.

Comparison of Alternatives

This table provides a brief summary of the alternatives and their environmental impacts in comparative format. Although there is no predictable acreage or timeframe for effects from the No Action alternative, the existing fuel load would continue to present a risk for high-intensity wildfire. Under Alternative 1, fire risk and the severity of wildfire effects to other resources would continue to increase over time.

Table 2-7. Alternative Effects Comparison Summary

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Acres Fuel Treatment by type and total	0	Hand = 4,954 Mechanical = 5,717 Total = 10,567	Hand = 5,950 Mechanical = 4,162 Total = 10,112
Surface Fuel Load	24 tons/acre overall average 8-66 tons/acre range	Surface fuel reduced to an average of 10-15 tons/acre	Surface fuel reduced to an average of 10-15 tons/acre on fewer acres than Alternative 2
Fire Type Acres	Surface, 407 Passive Crown, 6,578 Active Crown, 3,408 Crown fire not reduced	Surface, 8,774 Passive Crown, 1,424 Active Crown, 415 Crown fire reduced 89%	Surface, 8,564 Passive Crown, 1,138 Active Crown, 353 Crown fire reduced 89% on fewer acres than Alternative 2
Flame Length	<4 ft. 2,634 acres >4 ft. 7,742 acres 0 % change to <4 ft.	<4 ft. 6,525 acres >4 ft. 1,528 acres 80% of >4 ft. acreage changed to <4 ft.	<4 ft. 6,416 acres >4 ft. 3,722 acres 51% of >4 ft. acreage changed to <4 ft.
Forest Health – Stand Density, Basal Area	Basal area and stand density would continue to increase, leading to increased mortality from drought, insects, and disease.	Reduction in basal area would reduce stand density which in turn would reduce inter-tree competition and increase resistance to drought, insects, and disease.	Same as Alternative 2, but on fewer acres.
Conifer Species Composition	Shade-tolerant white fir and incense cedar would continue to increase; pine would continue to decrease. Lodgepole pine would continue to encroach on riparian areas, meadow, and aspen	Jeffrey, ponderosa, and sugar pines would be retained to increase the pine component in the forest toward desired conditions; conifer encroachment in riparian areas, meadows, and aspen would be reduced.	Same as Alternative 2, but on fewer acres.
Watershed Cumulative Effects	No Change Four HUC7 watersheds are currently over 100% Risk Ratio (RR); 3 due to existing development and 1 due to the Angora Fire	One HUC7 watershed, Camp Richardson Frontal, currently over 100% risk ratio would increase RR by more than 5%. 2 HUC7 watersheds currently under 100% would increase RR by more than 20%, but not exceed 100% RR, Tallac Creek and Taylor Creek	One HUC7 watershed, Camp Richardson Frontal, currently over 100% risk ratio would increase RR by more than 5%
Acres of RCAs treated **	0	6,253 acres	5,907 acres

	Alternative 1 No Action	**Alternative 2 Proposed Action**	**Alternative 3**
Acres of stream environment zone (SEZ) treated **	0	733 acres	693 acres
Meadow treatments to reduce conifer encroachment **	No treatment; water tables would continue to lower and meadow areas would continue to shrink due to conifer encroachment	Water tables would remain unchanged or rise; riparian vegetation such as willow would increase; meadow areas would remain or be enlarged.	Same as Alternative 2 only on fewer acres.
Acres of aspen treated to reduce conifer encroachment **	0 acres Aspen stands at risk would continue to be replaced by conifers	290 acres of aspen enhancement by removal of conifers	251 acres of aspen enhancement by removal of conifers
Permanent stream crossings	None replaced. Erosion, aggradation, and barrier to fish at these crossings would continue	Replace 2 crossings currently in disrepair; improve stream flow and channel connectivity.	Same as Alternative 2
Landings in riparian conservation areas (RCAs) & total landings	0	135 in RCAs 219 Total	80 in RCAs 168 Total
New temporary road construction	0	4.8 miles	3.6 miles
Existing temporary road reconstruction	0	15 miles	11 miles
Road maintenance	0	27 miles	27 miles
Visual quality	No effect*	Some short-term foreground impacts; meets standards, improves views into the forest interior, and of meadows, lakes, and aspen.	Minor short-term foreground impacts; meets plan standards; improves views into the forest interior, and of meadows, lakes, and aspen.
Recreation	No effect*	Short-term reduction in areas available for recreation from area closures during implementation for public safety; increased weekday traffic congestion.	Same as Alternative 2
Lahontan cutthroat trout (Threatened)	No effect*	May affect, not likely to adversely affect; no mortality expected; possible short-term sediment effect from thinning in SEZs; long-term habitat improvement	Same as Alternative 2
Lahontan tui chub (FS Sensitive)	No effect	May affect individuals not likely to lead to trend toward listing; no mortality expected;	Same as Alternative 2

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
		long-term habitat improvement	
Northern goshawk (FS Sensitive, TRPA special interest species)	No Effect,* No fuel reduction in 15 protected activity centers (PAC)	May affect individuals not likely to lead to trend toward listing; fuel reduction in 9 PACs; 42% of PAC acres, with prescription to maintain cover and habitat	May affect individuals not likely to lead to trend toward listing. Fuel reduction in 7 PACs; 31% of PAC acres, with prescription to maintain cover and habitat
California spotted owl (FS Sensitive)	No Effect* No fuel reduction in 9 PACs	May affect individuals not likely to lead to trend toward listing; Fuel reduction in 6 PACs, 31% of PAC acres, with prescription to maintain cover and habitat	May affect individuals not likely to lead to trend toward listing; Fuel reduction in 5 PACs; 23% of PAC acres, with prescription to maintain cover and habitat
Bald eagle (FS Sensitive, TRPA special interest species)	No Effect* No fuel reduction in winter habitat	May affect individuals not likely to lead to trend toward listing; supports the Pacific bald eagle recovery plan; treats fuels on 3,371 acres, of winter habitat; increases nesting habitat by 59 acres; retains nest, perch, and winter roost trees	May affect individuals not likely to lead to trend toward listing; supports Pacific bald eagle recovery plan, treats fuels on 3,653 acres of winter habitat; increases foraging habitat by 5 acres; retains nest, perch, and winter roost trees
Great grey owl (FS Sensitive)	No effect*	May affect individuals not likely to lead to trend toward listing. Not detected in the South Shore wildlife analysis area, retains ~90% of habitat	May affect individuals not likely to lead to trend toward listing; not detected in the South Shore wildlife analysis area; retains ~91% of habitat
Willow flycatcher (FS Sensitive)	No Effect*	May affect individuals not likely to lead to trend toward listing; long-term habitat improvement from removal of conifer encroachment in riparian/meadow nesting habitat.	Same as Alternative 2
Osprey (TRPA special interest species)	No Effect*	Thin small trees to reduce fuels on 370 acres (27%) of TRPA disturbance zones; schedule treatments to provide refuge areas; retain large trees used for nesting or perching.	Thin small trees to reduce fuels on 350 acres (26%) of TRPA disturbance zones; schedule treatments to provide refuge areas; retain large trees used for nesting or perching.
Waterfowl (TRPA special interest species)	No effect	Disturbance (flushing) during implementation; conifer removal would enlarge habitat and improve sight distance to avoid predation.	Same as Alternative 2
Townsend's big-eared bat (FS Sensitive)	No Effect*	May affect individuals not likely to lead to trend toward listing; would not affect habitat in caves, mines, talus slopes, tree-hollow roosts;	Same as Alternative 2

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
		would remain relatively abundant	
American marten (FS Sensitive)	No Effect*	May affect individuals not likely to lead to trend toward listing; less than 4% of denning, resting, or foraging habitat would be affected.	Same as Alternative 2.
Pacific fisher (Candidate)	No effect	No effect; outside the range of this species	No effect; outside the range of this species
California wolverine (FS Sensitive)	No effect*	May affect individuals not likely to lead to trend toward listing; No denning habitats and <4% of resting or foraging habitats would be affected.	Same as Alternative 2
Sierra Nevada red fox (FS Sensitive)	No effect*	No effect; activities would not occur within or create suitable habitat	No effect; activities would not occur within or create suitable habitat
Mule deer – critical fawning habitat (TRPA special interest species)	No effect	Treatments on 1,740 acres (21%) of estimated fawning habitat, conifer removal in aspen and meadow would improve those habitats; thinning in forest stands would reduce cover & forage in forest habitats but improve sightlines for predators.	Treatments on 1,689 acres (20%) of estimated fawning habitat, conifer removal in aspen and meadow would improve those habitats; thinning in forest stands would reduce cover & forage in forest habitats but improve sightlines for predators.
Management Indicator Species (MIS) – riverine & lacustrine (aquatic macro-invertebrates)	No effect*	Extend base flow time; short-term sediment possible; no change in stream temp; trend for macroinvertabrates remains stable.	Extend base flow time; less short-term sediment possible because fewer acres of treatment; no change in stream temp; trend for macro-invertabrates remains stable
MIS – Riparian (yellow warbler)	No effect*	496 acres of habitat would be enhanced by removal of conifer encroachment; change to deciduous species canopy; no change in bioregional trend or distribution of yellow warbler	466 acres of habitat would be enhanced by removal of conifer encroachment; change to deciduous species canopy; no change in bioregional trend or distribution of yellow warbler
MIS – Wet meadow (Pacific tree frog)	No effect*	115 acre increase in wet meadow habitat; increase in available water; would not alter bioregional trend for wet meadow or Pacific tree frog.	99 acre increase in wet meadow habitat; increase in available water; would not alter bioregional trend for wet meadow or Pacific tree frog.
MIS – Early and mid-seral coniferous forest (Mountain quail)	No effect*	600 acres (2.5%) would change to mid- or late-seral habitat; short-term 3% reduction in understory shrub cover; changes would not	467 acres (2%) would change to mid- or late-seral habitat; short-term 2.5% reduction in understory shrub cover; changes would not change the

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
		change the bioregional trend for habitat or the distribution of mountain quail	bioregional trend for habitat or the distribution of mountain quail
MIS – Late seral open canopy coniferous forest (Sooty blue grouse)	No effect*	Smaller understory trees would be thinned on~400 acres, but would not result in a change in overstory canopy; large acreage increase (~103%) from treatments in early and mid-seral stands within wildlife analysis area is relatively small across the bioregion; would not change the trend for this habitat or for the Sooty (blue) grouse.	Smaller understory trees would be thinned on~400 acres, but would not result in a change in overstory canopy; acreage increase (~74%) from treatments in early and mid-seral stands within wildlife analysis area is relatively small across the bioregion, and would not change the trend for this habitat or for the Sooty (blue) grouse.
MIS – Late seral closed canopy coniferous forest (CA spotted owl, American marten, northern flying squirrel	No effect*	Thinning of the smallest trees would result in a reduction in canopy closure class from dense to moderate for 15% of the acres treated; an increase of 144 acres (30%) in this habitat would occur from treatments in early and mid-seral habitat; these changes would not alter the trend in the 994,000 acres of this habitat in the bioregion, nor alter the trend for any of the indicator species.	Thinning of the smallest trees would result in a reduction in canopy closure class from dense to moderate for 15% of the acres treated; an increase of 139 acres (29%) in this habitat would occur from treatments in early and mid-seral habitat; these changes would not alter the trend in the 994,000 acres of this habitat in the bioregion, nor alter the trend for any of the indicator species
MIS – Snags in green forest (Hairy woodpecker)	No effect*	No change in total area containing snags, but snag density would be reduced on 5,517 acres (9%) of green forest in the wildlife analysis area that exceed LRMP standards; resulting snag densities are within the range observed in the bioregion and would not alter the trend for this habitat, nor change the distribution of the hairy woodpecker	No change in total area containing snags, but snag density would be reduced on 5,376 acres (9%) of green forest in the wildlife analysis area that exceed LRMP standards; resulting snag densities are within the range observed in the bioregion and would not alter the trend for this habitat, nor change the distribution of the hairy woodpecker
MIS – Snags in burned forest (Black-backed woodpecker)	Increased risk of high intensity wildfire would potentially increase burned forest and snags in burned forest; snag densities would likely be within the range observed in the bioregion and are not likely to alter the trend for this habitat, nor	No change in total area containing snags, but snag density would be reduced on 315 acres (9%) of burned forest in the wildlife analysis area that exceed LRMP standards; resulting snag densities are within the range observed in the bioregion and would not alter the trend for	Same acres treated as Alternative 2, effects are also the same.

	Alternative 1 No Action	**Alternative 2 Proposed Action**	**Alternative 3**
	change the distribution of the black-backed woodpecker	this habitat, nor change the distribution of the black-backed woodpecker	

* Although there is no predictable direct effect from the No Action alternative, the existing fuel load would continue to present a risk for high-intensity wildfire, and this risk would increase over time.

** SEZs and Aspen overlap with RCAs.

Chapter 3

Affected Environment & Environmental Consequences

Council on Environmental Quality (CEQ) regulations direct that agencies succinctly describe the environment that may be affected by the alternatives under consideration (40 CFR 1502.15). This Chapter describes the existing physical, biological, social, and economic aspects of the project area which have the potential to be affected by implementing any of the alternatives (i.e., the existing conditions). Each description of the existing conditions is followed by a description of the environmental effects (direct, indirect, and cumulative) that would be expected to result from undertaking the proposed action or other alternatives. Together, these descriptions form the scientific and analytical basis for the comparison of effects table found at the end of Chapter 2.

Organization of Chapter 3

Chapter 3 combines information on the existing conditions and environmental effects of the alternatives for the various resources. The information is separated into these resource areas for ease in reading. The discussion of alternatives is organized by resource area and presented in the following order:

Scope of the Analysis, Indicators, and Issues

The scope of the analysis briefly describes the geographic area(s) for the individual resource and its indicators potentially affected by implementation of the alternative. The scope of the analysis varies according to individual resource area and may also vary for direct, indirect, and cumulative effects.

Existing Conditions

The existing conditions section provides a description of the resource environment that is potentially affected based on current resource conditions, uses, and management decisions.

Direct and Indirect Environmental Consequences

This section provides an analysis of direct and indirect environmental effects to the resource area of implementing each of the alternatives, according to the indicators and issues identified for that resource.

Direct effects are caused by the actions to implement an alternative, and occur at the same time and place.

Indirect effects are caused by the implementation action and are later in time or removed in distance, but are still reasonably foreseeable (i.e., likely to occur within the duration of the project)

Cumulative Effects

Cumulative effects are the result of the incremental direct and indirect effects of any action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant actions, taking place over a period of time. See Appendix A for a table discussing the past, present, and future restoration projects within the project area and Map 6 for location of the projects.

Irreversible and Irretrievable Commitments of Resources

An irreversible commitment is a permanent or essentially permanent use or loss of resources that cannot be reversed except in the extreme long term. Examples of irreversible commitment of resources include mineral extraction or loss of soil productivity.

An irretrievable commitment of resources is a loss of production or use of resources for a period of time. One example is the use of forested land for a road; tree growth on that land is irretrievably lost while the land is a road, but the land could grow trees in the future if the road were removed, thus the resource loss is reversible.

A. Fire and Fuels

Scope of the Analysis, Indicators, and Issues

Fire behavior is the manner in which a fire reacts to available fuels, weather, and topography. Fire behavior is complex, with many contributing factors; the most critical of which are topography (slope, aspect, elevation), weather (climate, air temperature, wind, relative humidity, atmospheric stability) and fuels (size, type, moisture content, total loading, arrangement) (Agee 1993). Weather conditions such as drought, high temperature, low humidity, and high wind play a major role in the spread of wildfires and are influenced by topography and location of mountains as well as global influences such as La Niña and El Niño. Weather conditions are a major factor in the initiation and spread of all wildfires. A change in any of these components results in a change in fire behavior (DeBano et al. 1998). Topography and weather at a given location are beyond the ability of management to control. Fuel hazard is the only controllable factor. Omi and Martinson (2002) found that stands with prior fuel treatments experienced lower wildfire severity than untreated stands burning under the same weather and topographic conditions.

At issue is the risk for high intensity catastrophic wildfire in the project area directly and the ability of wildfire to spread into adjacent areas of all ownerships with the consequent potential risk for loss of life, property, and natural resources. While activities to reduce fuels and promote healthy forest conditions would occur on individual treatment units within the wildland urban intermix (WUI), the effects of implementation of any of the alternatives potentially extend through the entire South Shore project analysis area.

Fire Behavior Modeling

Fire behavior indicators that are used to measure both the effectiveness and the environmental effects of the alternatives include: expected fire type, rates of spread, and fire intensity. This analysis is based on field reconnaissance of the project area beginning in fall of 2005 and a variety of data sources including IKONOS imagery and GIS data.

In order to analyze fire effects more thoroughly, fire behavior was modeled at both the fine scale of individual stands and at the coarser landscape scale to analyze the interaction of vegetation across the landscape. Results from the different analysis scales are only roughly comparable, because the high variability of the individual stands is blended together in the landscape scale analysis. While both scales of fire behavior analysis are useful, they need to be considered together, because the individual stand conditions plus the condition and behavior of neighboring stands influence wildfire behavior.

The fire behavior of an individual stand is useful to design an effective treatment prescription for that stand, while the landscape fire behavior models analyze the effectiveness of the treatments across the multiple stands in the project.

Individual stand inventory data from the project area supplied current condition information. Post treatment modeling using the West Side Sierra Nevada variant of the forest vegetation simulator (FVS) (USDA FS 2006) supplied post-treatment individual stand conditions. The FVS program is a model for predicting forest stand dynamics. The effects of the proposed treatments are based on FVS projections of stands with inventory data and are representative of average stand conditions. Individual treatment stands were then modeled using FVS and the fire and fuels extension (FFE) to FVS to project fire behavior and effects of individual stands for all three alternatives.

Landscape-level fire behavior was modeled utilizing two fire simulation programs; FARSITE and FLAMMAP. Both models use spatial information for topography and fuels along with weather and wind files. FARSITE incorporates the existing models for surface fire, crown fire, spotting, post-frontal combustion, and fire acceleration into a two-dimensional fire growth model.

FlamMap is not a fire growth simulation model; there is no temporal component in FlamMap. It uses spatial information for topography and fuels to calculate fire behavior characteristics at a single time. Landscape level fire behavior was modeled for the alternatives using fuels management analyst plus (FMAPlus) and FlamMap software. FlamMap software creates raster maps of potential fire behavior characteristics (rate of spread, flame length, crown fire activity, etc.) and environmental conditions (dead fuel moistures, mid-flame wind speeds, and solar irradiance) over an entire landscape. These raster maps can be viewed in FlamMap or exported for use in a GIS, an image file, or a word processor. FlamMap incorporates the following fire behavior models; Rothermel's 1972 surface fire model, Van Wagner's 1977 crown fire initiation model, Rothermel's 1991 crown fire spread model, Nelson's 2000 dead fuel moisture model.

Wildfire Hazard Analysis

The information used by fire behavior models to generate fire type, rates of spread, and fire intensity comes from a site-specific wildfire hazard analysis. A wildfire hazard analysis identifies the availability of fuels to sustain a fire. Wildfire hazard for any particular forest stand or landscape indicates the potential magnitude of fire behavior and fire effects as a function of fuel conditions. Understanding the structure of fuels and their role in the initiation and propagation of fire is needed to develop effective fuel management strategies. Natural forest fuels are important components for determining fire hazard, and are generally described in three categories:

- Surface fuels, which are composed of grass, herbs, low-lying shrubs, litter, and dead and down woody material that are in contact with the ground.
- Ladder fuels, which are composed of live and dead shrubs and understory trees, which contact from the surface fuels to the lower crowns of overstory trees.
- Canopy fuels, which are the live and dead material in the crowns of trees (Petersen et al. 2003).

Reducing fuels reduces fire intensity and severity, allowing firefighters and land managers more control of wildland fires by modifying fire behavior (Pollet and Omi 2000). Fuel management modifies fire behavior, ameliorates fire effects, and reduces fire suppression costs and danger (DeBano et al. 1998). Fuels management can include reducing the loading of available fuels, lowering fuel flammability, or isolating or breaking up large continuous bodies of fuels (DeBano 1998). Fuels contribute to the rate of spread of a fire, the intensity/flame length, the fire residence time, and the size of the burned area (Agee et al., 2000). For these reasons, the comparison of alternatives in this analysis focuses on the reduction of important fuels, fire behavior indicators, and relative rating of fuel hazard within the WUI.

A wildfire hazard assessment analyzes crown fire potential as well as surface fire potential. Crown fires are usually highly destructive, difficult to control, and present the greatest safety hazard to firefighters and the public. In general, crown fires burn hotter and result in more severe effects than surface fires. Therefore, the emphasis of fuel management is on the factors that contribute to the initiation and spread of crown fires. Agee (1996) states that crown fire potential can be managed through prevention of the conditions that initiate crown fires and allow crown fires to spread. The three main factors contributing to crown fire behavior that can be addressed through fuels management are: initial surface fuels, crown base height, and crown bulk density.

Wildfire Behavior Factors

Crown fire initiation and crown fire spread are related to several conditions. The intensity of surface fire must be relatively high, coupled with low foliar moisture content of the live vegetation. Fine surface fuels are generally the primary carriers of fire. Fine surface fuels are course down woody material with diameters of 0.1 to 3.0 inches. The amount of these fuels present is an important factor in determining how fast a surface fire will spread and how hot it will burn under given atmospheric and topographic conditions. Anderson (1982) identifies fine surface fuels as the primary carrier of fire at the flaming front. These fuels directly affect fire intensity and spread by linking fire from the surface into the ladder fuels, which often leads to propagation of fire into the crowns of trees under 90th percentile weather conditions.

In order for a crown fire to initiate, a surface fire must be intense enough to ignite the lowest level of branches that will propagate fire to the upper levels of the canopy. A measure of surface fire intensity is flame length. Flame length is the average distance (feet) from the fire's surface to the top of a flame. The rule, developed by the National Wildfire Coordinating Group (NWCG), is that once flame lengths exceed 4 feet, firefighters on the ground would not directly attack fire. Flame lengths less than 4 feet can usually be attacked successfully with hand tools and hand constructed fire line should hold the fire. Flame lengths greater than 4 feet are too intense for direct attack on the head of the fire using hand tools and a hand line cannot be relied on to hold the fire. Equipment such as bulldozers, engines, and retardant aircraft can be effective at the head of the fire for flame lengths between 4 and 8 ft. Flame lengths greater than 8 feet generate fire conditions where direct attack at the head of the fire is generally not successful and suppression tactics must rely on flanking and indirect attack methods. Generally indirect attack results in a fire burning through one or more burn periods (part of each 24 hour day when fires will spread most rapidly, typically from 10:00 am to sundown). Higher flame lengths indicate greater fire intensity. Flame length is just one indicator for fire control resistance and lethal fire effects. The likelihood of a fire to become a crown fire is also based on fire line intensity (Btu/ft/s measured at the head of the fire) as well as crown base height, foliar moisture, crown bulk density, topography, and weather.

Crown base height (CBH) and crown bulk density (CBD) are two critical factors in predicting crown fire propagation and spread. CBH is the average height (feet) from the top of the surface fuel to the lowest part of a tree's crown where there is sufficient crown fuel to spread fire vertically into the canopy (Scott and Reinhardt 2001). CBH includes ladder fuels such as shrubs and understory trees as well as the live and dead lower branches of mature trees. It is measured at the lowest height above ground where at least 0.010 kilograms per cubic meter (kg/m^3) of available canopy fuels are present. The lower the crown base height, the easier it is for a surface fire to initiate a crown fire. Low crown base height provides the "ladder" which allows a surface fire to become a crown fire.

Crown bulk density is defined as the amount of available canopy fuel per unit of canopy volume. Crown bulk density is the average mass (kg/m^3) of tree crowns across a forest stand (Brown and Smith, 2000). Crown bulk density is a property of a stand, not an individual tree, and is measured as the available canopy fuel load divided by canopy depth (Scott and Reinhardt 2001). In order for a crown fire to persist, the canopy must be dense enough for the fire to spread from one tree's branches to another tree. Once a fire gets into the crown of the trees, two factors determine whether a crown fire is sustained or not: surface fire rate of spread and crown bulk density (CBD) (Alexander 1988; Van Wagner 1977). Stands with high CBD can sustain a crown fire that began outside the stand, even when surface fire intensity and CBH are such that fires that start within the stand itself will not transition into a crown fire.

Thinning to reduce crown bulk density to less than 0.10 kg/m^2 is generally recommended to minimize crown fire hazard when a fire moves into an area from an outside point source (Agee 1996). For any given species, more widely spaced trees have a lower canopy bulk density, which makes it more difficult to maintain a crown fire.

Fire Types

Surface fires are generally considered to be non-lethal although smoldering activity in deep duff layers or in large down fuels can sometimes result in increased mortality in conifers. Passive crown fire generally occurs in pockets of high fuel loadings, high crown bulk density, and a low height to live crown where isolated torching of crowns can occur. Torching trees and burning snags can also scatter burning embers in front of the main fire at times initiating spot fires that can burn together and/or increase the rate of spread of the main fire. Passive crowning is usually a mixture of lethal and non-lethal fire effects. Active crown fire is generally sustained crown fire activity, dependant on larger areas with elements conducive for crowning. With active crown fires, spotting can also occur. Independent crown fire, where the forward rate of spread is independent of the surface fire rate of spread, can also occur.

Rate of Spread

Rate of spread is the relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area. Usually it is expressed in chains or acres per hour for a specific period in the fire's history. A chain length is 66 feet, and rate of spread in chains/hour is a measurement of how fast a fire is moving at the head. Crown fires generally spread at least two to four times faster than surface fires (Rothermel 1983). Fires that spread quickly and at higher intensities present a greater risk to firefighters and the public. Flame lengths of four feet or less that can be directly attacked by hand crews and engines allow faster fire line construction and generally result in smaller fire size.

Wildfire Effects for Stand Composition and Structure

Composition is defined as the tree species and their proportional representation in any given forest stand. Structure is defined as canopy classes and their proportional representation in a given forest stand. The tree and brush species that are present in the project area would be affected by fire in a variety of ways. A summary of these effects is described in Table 3-1.

Table 3-1. Effects on vegetation from fire

Species	Effects of Fire
Ponderosa pine /Jeffery Pine	Ponderosa pine is adapted to fire. It has thick bark, medium to large size buds, long needles, open crown structures, and becomes resistant to fire at the sapling to pole size. Burning would be conducted in this project area in the spring, early summer, and fall. There would be some scorching of the crowns resulting from prescribed fire. An effect of the scorching would be the pruning of the lower branches thus raising the crowns of the trees. This raising of the heights of the trees tree crowns would make it harder for crown fire initiation.
Douglas-fir	Douglas-fir can survive moderately intense fires. It has thick corky bark on the lower bole and roots that protect the cambium form damage. Seedlings and saplings are susceptible to and may be killed by even low-intensity ground fires.
Sugar pine	Mature sugar pine is very resistant to low to moderate severity fires. It has adapted a thick, fire resistant bark and open canopy that retards aerial fire spread. Young sugar pines are susceptible to low to high severity fires.

White fir	Sapling and pole size white fir are sensitive to fire due to the thin bark, low growing branches, and shallow roots. As the trees mature, the bark becomes thicker and is able to resist fire.
Incense-cedar	Seedlings and sapling size incense-cedar are readily killed by fire. In studies conducted in northern California a low severity fire killed nearly all seedlings and saplings. Mature incense cedar’s thick bark offers sufficient protection from excessive heat. Most studies find that only a high intensity surface fire would kill an occasional mature incense cedar.
Red fir	Seedlings of red fir are easily killed by fire. Low intensity fires kill seedlings and saplings of red fir. The bark of older red fir is thick and fire resistant. The needles and branch tips are resistant to fire. Larger California red fir are able to withstand low severity fire but are killed by high severity fires.
Black oak	California black oak has adapted to fire by sprouting from the root crown. Further fire adaptations include an extensive root system capable of supporting vigorous sprouting, and seedbed requirements (mineral soil or light duff) matching those produced by light- or moderate-severity fire.
Lodgepole pine	Lodgepole pine is usually killed by fire due to its thin bark and shallow root system. Lodgepole pine burns in a stand replacement manner and following fire becomes established in even-aged stands.
Greenleaf manzanita	Greenleaf manzanita is adapted to fire. It has volatile oils in its leaves, low moisture in its leaves in the summer, and persistence of dead branches and stems. Sprouting from the root burl follows burning of the plant. In some areas, sprouting occurs from seed source in the soil after scarification has occurred.
Ceanothus	Ceanothus species are adapted to fire. Seeds retain their viability for several years and following a fire to scarify the seeds, they would sprout. The plant also has the ability to sprout from the root crown, if there is no damage to the root crown from fire.

Source: Brown and Smith 2000

Existing Conditions

Affected Environment

The South Shore project treatment area is located entirely within the wildland urban interface (WUI) as defined by the Sierra Nevada Forest Plan Amendment Record of Decision (2004). See Map 5 for location of the WUI.

The fire and fuels affected environment for the South Shore project area is described by the following parameters: historic fires, fire regime condition class, fire weather, fire hazard assessment, existing fuel conditions, and fire behavior.

Historic Fires

Fire risk refers to the probability of an ignition occurring as determined from historical fire record data. The project area experiences both human and natural fire starts with the majority of the fires being human caused. Fire risk due to lightning cannot be changed. From 1976-2003 were mapped for the analysis area and are shown in Map 7. Fire starts for the analysis area were compared with fire starts for the entire Lake Tahoe Basin. With 50% of the Lake Tahoe basin acreage, the analysis area accounts for 50% of the fire starts. Over 75% of the fire starts in the project area were human caused. A breakdown of data of fire starts is shown in Table 3-2.

Table 3-2. Fires recorded in / around the South Shore project area by cause

Area	Acres	Human Starts	Natural Starts	Total Starts
Fires within Lake Tahoe Basin	209,016	1,191	321	1,512
Fires within project area (excluding lakes)	105,376	616	190	806
Project Area as a Percentage of Lake Tahoe Basin				
Project area	50%	52%	59%	53%
Fire starts within the Basin	N/A	79%	21%	100%
Fire Starts within project area	N/A	76%	24%	100%

The Angora Fire (June and July, 2007) located to the north of and adjacent to the South Shore project area demonstrated how fire would likely behave in the vegetation and fuels in the project area under severe fire weather conditions. The vegetation types in the Angora Fire were similar in stand structure and species composition to the South Shore project. Some of these vegetation types burned at moderate and high intensities and were severely damaged, with entire stands of trees killed as a direct result of fire behavior. With similar weather and existing fuel conditions, a fire in the South Shore project area without treatment would experience similar moderate to severe fire intensity.

Fire Return Interval

The fire return interval (FRI) within the project area ranges between 5-32 years (Murphy and Knopp 2000). Fires occurring during settlement and pre-settlement periods occurred frequently and were low to moderate in severity, burning primarily on the forest floor. Low and moderate severity fires consume patches of fuel and kill mostly seedlings and saplings in the understory. Occasionally small groups of main canopy trees are killed (Taylor 1999). This fire regime creates a multi-aged forest with open and closed canopy conditions and heterogeneous fuels, and leads to a shifting mosaic of steady-state forest at the landscape level. This fire regime and the resulting forest mosaic also impede development of high severity fire (Bonnicksen and Stone 1982).

The 2000 watershed assessment showed that the fire risk within the project area has increased from relatively low in the 1970s to high risk under the current vegetative and fuels conditions (Murphy & Knopp 2000). Recently, fire starts are increasing due to the population growth and an increase in public recreation in the South Shore project area. This trend is likely to continue into the future.

Condition Class

Condition Class is defined in terms of departure from the historic fire regime. Condition class is determined by the number of missed fire return intervals with respect to the historic fire return interval, for the stand structure and tree species composition of any given vegetation type. Departure from historical fire regimes results in alteration of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Various combinations of activities have caused this departure: fire suppression, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), and other past management activities. The relative risk of fire-caused losses of key ecosystem components increases as Condition class numbers increase, with little or no risk at the condition class 1 level, and high risk for loss of key ecosystem components at condition class 3. Figures 3-1 through 3-4 are representative stands within the South Shore project area. They show existing examples of three condition classes used to categorize the existing condition of the project area by Fire Regime (Laverty and Williams 2000).

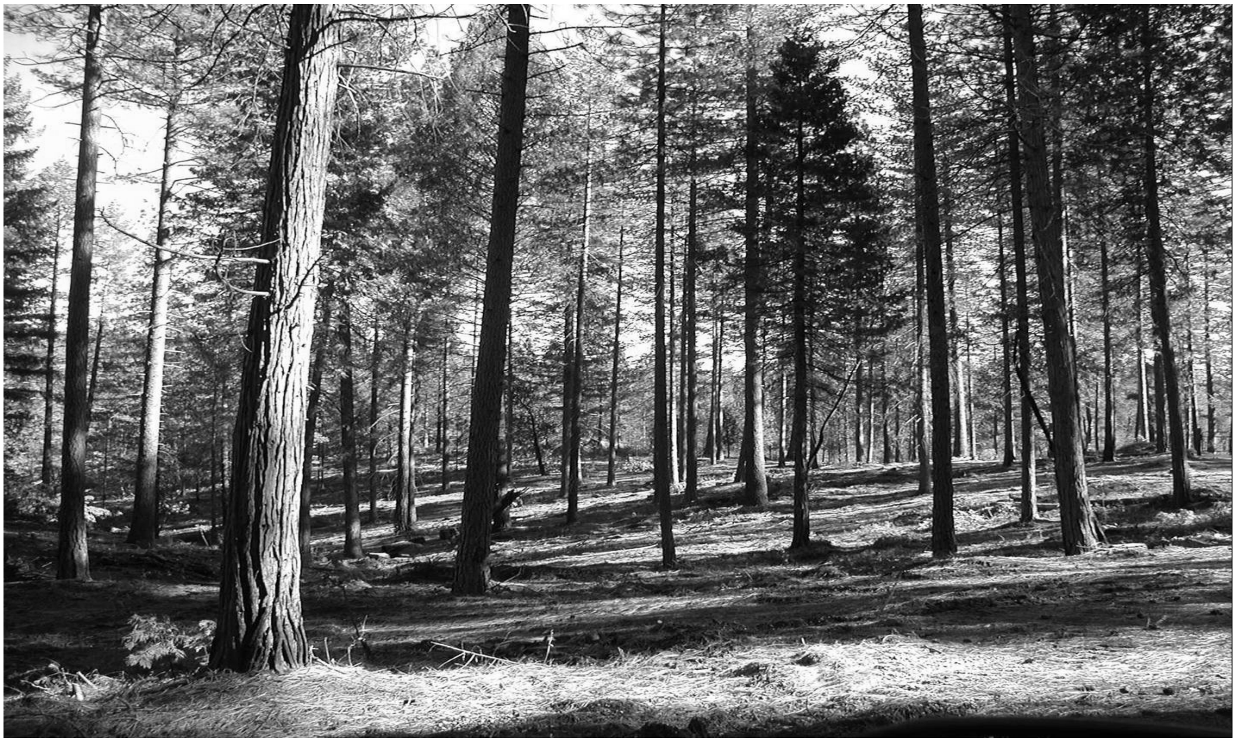


Figure 3-1. Condition Class 1 in mixed conifer within the South Shore project area

Condition class 1: Fire regimes are within a historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. The photograph shown above in Figure 3-1 is of a stand within the project area that exhibits condition class 1 characteristics in the mixed conifer vegetation type. This mixed conifer stand was thinned to approximate crown closure of 40% in early 2000. Previously implemented vegetation management activities in the stand are consistent with the fuels reduction and healthy forest objectives for this project.

Condition class 2 Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). The result is moderate changes to one or more of the following: fire size, fire intensity and severity, and landscape fire patterns. Vegetation attributes have been moderately altered from their historical range. The photograph shown in Figure 3- 2 is of a stand within the project area that exhibits the characteristics of condition class 2 in the mixed conifer and red fir vegetation types.

Condition class 3: Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. The result is dramatic changes to one or more of the following: fire size, fire intensity and severity, and landscape fire patterns. Vegetation attributes have been significantly altered from their historical range. The photographs shown in Figures 3-3 and 3-4 are of stands within the project area that exhibit the characteristics of condition class 3 in the mixed conifer vegetation type. Neither of these stands has received vegetation or fuels treatments.

Figure 3-2. Condition Class 2 in mixed conifer within the South Shore project area

Figure 3-3. Condition Class 3 in mixed conifer within the South Shore project area

Figure 3-4. Condition Class 3 in mixed conifer within the South Shore project area

Fire Weather

The Meyers remote automated weather station (RAWS), located within the project area, was selected to obtain 90th percentile weather data for use in fire behavior modeling. The 90th percentile weather represents the “average worst” weather conditions for days when fires occur. These conditions would be in effect on 10 percent of all the days that large fires occur on the LTBMU. The 90th percentile fire weather indices were obtained from station recordings dating back to 1970. Table 3-3 displays the 90th percentile weather indices that were used for modeling fire behavior inside the South Shore project area and are consistent with extreme fire weather.

Table 3-3. 90th percentile fire weather data for Meyers, California

Fuel/Weather Variable	90th Percentile Values
1 Hour Fuel Moisture, %	4
10 Hour Fuel Moisture, %	6
100 Hour Fuel Moisture, %	10
1000 Hour Fuel Moisture, %	13
Herbaceous Fuel Moisture, %	70
Woody Fuel Moisture, %	70
20 Foot Wind Speed, MPH	25
Dry Bulb Temperature, Degrees F	80

Source: Meyers Remote Automated Weather Station

Surface Fuel Loads

Total surface fuel loading for the project area is moderate to heavy, with averages ranging from 8 to 66 tons per acre. Surface fuels (0-3 inches) range from moderate to extreme (Table 3-4). In some areas dead and down fuel accumulations are as high as 80 tons per acre. Surface fuels greater than 3 inches also contribute towards wildfire intensity, resistance to control, and spotting, but they are not used in the fire behavior-modeling algorithm.

Table 3-4 Average Fuel Loads

Size Class	Tons per Acre
0-1/4” (1 hour fuels)	0.5-2.0 t/a
1/4-1” (10 hour fuels)	2.0-6.0 t/a
1-3” (100 hr fuels)	2.0-12.0
3+ “ (1000 hr fuels)	3.5 -46.0 t/a
TOTAL tons/acre	8-66 t/a

Currently, 177 proposed treatment stands totaling 7,408 acres are above desired surface fuel loads of 10 to 15 tons per acre. The overall average is 24 tons.

Fire Behavior

The overall fire hazard for the South Shore project area is high. Existing fuel conditions are highly variable, with large areas of hazardous fuel accumulation, especially within the WUI.

The majority of stands proposed for treatment are moderately to densely stocked, with crown closures greater that 50%. These stands are overstocked with poles and small trees (3 to 24 inches dbh), but generally understocked with medium and larger sized trees (24 inches dbh or larger). Shade tolerant species, predominantly white fir, have encroached around and under fire tolerant trees (Jeffery/ ponderosa pine) throughout the project area. This invasion has created hazardous ladder fuel conditions, greatly increasing the potential for fire to spread into the crowns of trees, and also increased potential of crown fire spread. Crown base height across the project area currently ranges between 0 to 9 feet in the project area. This CBH range is considered hazardous because tree crown bases are near the ground and are likely to be in contact with other existing vegetation (shrubs) and are relatively close to surface fuels. Crown bulk density across the project area currently ranges between 0.11 to 0.30 kg/m^3. CBD is considered moderate to high in hazard when CBD is above 0.10 kg/m^3.

Flame length is one indicator for fire control resistance and lethal fire effects. Under current conditions approximately 10% of the project area is expected to burn with flame lengths less than 4 feet; approximately 20% is expected to burn with flame lengths between 4 and 8 feet; and approximately 70% is expected to burn at flame lengths greater than 8 feet. Predicted Fire Type

Fire fuels extention (FFE) to the FVS program was used to model the predicted fire type that would occur in a stand based on current conditions. The predicted fire type is based on severe conditions represented by the 90th percentile weather conditions. Some of the variables FFE used for predicted fire activity include: fuel model, stand density including both live and dead trees, tree species, canopy bulk density, crown height, and fuel loads. FFE uses fire types A (Active), C (Conditional), P (Passive), and S (Surface). A C (Conditional) fire means that depending on the type of fire as it enters a stand would determine what type of fire that stand would have. If a fire enters a stand as a ground fire from an adjoining stand, it would stay a ground fire when it burns through the C (Conditional) fire type stand.

Approximately 16% of the stands are A (Active), 29% are C (Conditional), 9% of the stands are fire type P (Passive), and 46% are S (Surface) fire type stands (Figure 3-5). The desired predicted fire type for all stands within the project area would be Surface, where expected behavior would be that of low intensity ground fires.

Data collected in the hand thinning stands, including wildlife, did not include trees less than 5 inches dbh. Fuel ladders that may exist in the stands are not accounted for and therefore the amount of S (Surface) fire type represented is overestimated (Figure 3-5).

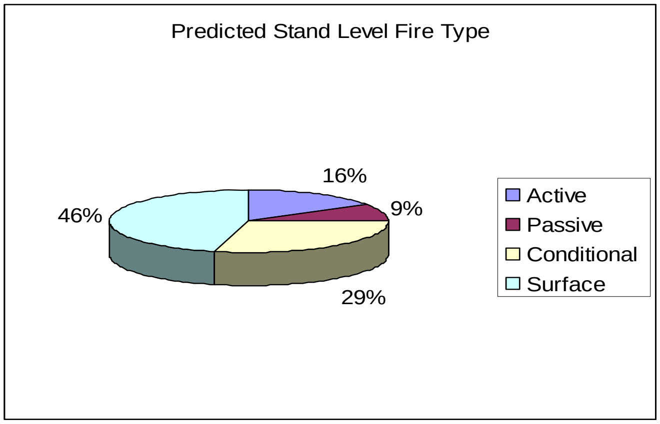


Figure 3-5. Current predicted stand level fire types for proposed treatments

Direct and Indirect Environmental Consequences

The alternatives were modeled for fire behavior and fire effects on stand composition and structure using the FVS, and Flammap for landscape level treatments as described previously. Weather modeling parameters are those described above in Table 3-3 under 90th percentile fire weather. Alternatives 2 and 3 describe the fundamental changes from Alternative 1 (no action/existing conditions) that would occur from the differences between the three alternatives.

The effectiveness of treatments in modifying fire behavior was discussed in the 2004 SNFPA FSEIS, Chapter 3-5, pages 286 to 288. Additional discussion on the effectiveness and placement of fuel treatments across the landscape is discussed in the 2004 SNFPA FSEIS. The fuel treatments proposed in Alternatives 2 and 3 would employ a combination of mechanical harvest, mastication, hand thinning, and prescribed fire treatments.

Alternative 1 (No Action)

Under the No Action alternative, fuels reduction activities would not occur, and fuel would continue to accumulate. Sierra Nevada Forest Plan Amendment standards to achieve desired conditions for wildland fire behavior would not be met over most of the project area. The expected outcome for Alternative 1 is illustrated by effects from the 2007 Angora Fire in areas where there were no fuel reduction treatments prior to the Angora Fire.

The No Action alternative would not reduce the fuels in the treatment areas and fuel loads would remain heavy. High surface fuel loading and low canopy base heights would continue in most stands. The existing dense canopy has high crown bulk densities that can sustain a crown fire. (See Map 8 for location of potential crown fire activity under existing condition.) Both surface and ladder fuels would continue to increase, which would increase the risk of a high intensity fire. Fire starts are expected to occur in a random manner in the project area and to continue to do so in the future. The number of starts in the project area is expected to remain about the same in the future as in the recent past.

The absence of fuels treatment over time would create a situation where continual increase in fuel loading would occur across the project area. Down woody material would continue to be added to the forest floor annually at a rate that is greater than decomposition. Absence of thinning would allow the continued ingrowth of trees that are shade-tolerant, but not fire-tolerant. As understory ingrowth trees and shrubs increase in density, stands would become stressed and mortality would increase. As the understory and canopy vegetation begin to die, fuel loading on the forest floor would amplify. Dead brush and trees left standing would serve as ladder fuels. These factors, individually and combined, would cause an increase in the probability of wildfire to result in stand replacement. The predicted increase in intensity of fire behavior would also create a high rate of mortality in any residual trees. Across the project landscape condition classes would remain at 2 and 3.

Under 90th percentile weather conditions, modeling predictions are that flame lengths in a wildfire would be in excess of four feet in much of the project area and rate of spread would increase. Fire type would be less likely to be a low-intensity surface fire and more likely to be a high intensity crown fire. Fire hazard in the area over time would become more severe and the potential for large, difficult to control fires would increase. Severe fire behavior would be expected to create a situation where direct fire line attack would be prohibited. This condition would allow fires to become considerably larger and potentially more hazardous for firefighters and the communities at risk. The threat of wildfire moving into communities lying within the South Shore project analysis area would remain high.

The No Action alternative was modeled for fire behavior and fire effects on stand composition and structure using the forest vegetation simulator (FVS), the fire and fuels extension (FFE) to FVS, and fuels management analyst (FMA). Modeling for fire behavior, CBH, and CBD, was done on all stands within the South Shore project area. Modeling parameters are those described in Table 3-3 for 90th percentile fire weather.

Surface Fuel Loads

Table 3-5 displays modeled outputs for surface fuel loading for the No Action alternative. Although none of these stands would be treated under Alternative 1, stands are grouped by the treatment types that are proposed under Alternative 2, to facilitate comparison of the alternatives.

With the No Action alternative, there would be an increase in stand densities resulting in less growth and vigor and increase in mortality. Over time, the increase in stand densities would contribute to a continued increase in surface fuel loads within the stands (Table 3-5). The desired maximum of 10 to 15 tons per acre would not be met. This would ultimately result in greater risk of wildfire and other higher intensity natural disturbances.

Table 3-5. Current and future predicted fuel loads

Treatment Type	Current Ave Total Fuel Loads Tons/acre	10 Years Ave Total Fuel Loads Tons/acre	20 Years Ave Total Fuel Loads Tons/acre
Hand Thin Stands	21	24	30
Mechanical Stands	23	28	36
Wildlife Stands	25	29	37

Fire Behavior

For current and predicted stand conditions Table 3-5, data collected in the hand thinning stands, including wildlife, did not include trees less than 5 inches dbh. Fuel ladders that may exist in the stands are not accounted for and therefore the amount of S (Surface) fire type represented is overestimated.

With no treatment, the predicted fire type includes an increase in stand densities, resulting in less tree growth and vigor, and an increase in mortality. Current predicted fire types under severe conditions would change over time. The type of change would be based on factors such as increased fuel loads, canopy bulk densities, stand densities, mortality, and changes to fuel ladders based in part on canopy heights.

Table Fire 3-6. Modeled fire behavior results for the No Action alternative

Current Conditions	Fire Type			
	Surface	Passive Crown	Conditional Crown	Active Crown
Hand Treatment Stands	85%	4%	8%	3%
Mechanical Treatment Stands	38%	12%	23%	27%
Wildlife (PAC) Stands	35%	10%	38%	17%
All Stands	46%	9%	29%	16%
10 Years				
Hand Treatment Stands	84%	6%	7%	3%
Mechanical Treatment Stands	27%	14%	21%	38%
PAC Stands	31%	11%	41%	17%
All Stands	42%	10%	30%	18%
20 Years				
Hand Treatment Stands	90%	0%	10%	0%
Mechanical Treatment Stands	23%	7%	39%	31%
PAC Stands	31%	9%	51%	9%
All Stands	42%	7%	39%	12%

Stands that have lower densities, such as those that have been thinned within the past 10 to 20 years, would be less susceptible to density related mortality; however, they would have an increasing composition of shade tolerant trees as these species continue to establish and grow in the understory. The amount of natural regeneration would depend on the size of the openings and would ultimately contribute to fuel ladders that would alter the type of predicted fire type for the stand. As the dominant and co-dominant trees grow, the fuel ladders that exist due to low canopies would decrease as the canopy base heights increase with increasing height of the trees.

The dynamic stand conditions would cause the stand level predicted fire types to change over the next 10 to 20 years, including an increase in acres for the A (Active) after 10 years and then a decrease from 10 to 20 years (Table 3-6). The S (Surface) fire type decreases over the next 10 years, and then increases from 10 to 20 years (Table 3-6). The desired condition of having all stands of the S (Surface) fire type would not be met.

Alternative 2 (Proposed Action)

Sierra Nevada Forest Plan Amendment standards to achieve desired fuel conditions for wildland fire behavior would be met over the entire project area. Surface fuel would be reduced. Stand density would be reduced, ladder fuels conditions would be reduced to decrease crown fire propagation and spread. Alternative 2 is the more aggressive fuel reduction alternative, allowing more mechanical treatments which are capable of removal of greater fuel loads. The goal for Alternative 2 is to conduct vegetation and fuels treatments that will meet the desired conditions for flame length as outlined in SNFPA treatments and reduce the flame lengths to less than 4 feet at the head of the fire. These treatments would change the project area from a Condition Class 2 or 3 toward a Condition Class 1 or 2 by reducing surface fuel loads and stand densities.

Alternative 2 would implement the WUI strategy as outlined in the Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (2004). Alternative 2 would provide a more open canopy and reduce the density of understory trees and surface fuels loads. Alternative 2 would alter stand structure and species composition, resulting in a fire environment that is less hazardous, thus protecting people and natural resources. Post-treatment stands would more closely reflect Condition Class 1 or 2. Reduction of surface fuel loads would result in shorter flame lengths, lower fire intensities, decreased acres of passive and active crown fires and reduced tree mortality in the event of wildfire.

Alternative 2 would result in reduced aerial and surface fuel loads. The indirect effect would be to reduce hazardous wildland fire behavior from fires both originating within treatments and from outside point sources (Graham et al. 1999). Treatment of surface, ladder, and canopy fuels would further help protect communities and resources in and around the project area while increasing safety for firefighters. These changes would, in turn, lower the potential of large-scale events.

Treatments in Alternative 2 would be effective in reducing the potential size and severity of wildfires, while providing fire suppression personnel safe locations for taking action against wildfire. Treatments to decrease surface loads would also increase firefighter capability for fire line production. A fire in the treated areas would likely be smaller when crews arrive and would be moving slower, making it easier to contain with fewer fire crews. Direct wildfire attack and fire line production rates would improve.

Direct Effects

Thinning followed by fuels treatment could result in a microclimate change that would encourage the growth of grasses, forbs and brush. Underburning would also encourage this type of growth. This microclimate change could also increase the drying of the surface fuels. In the event of a wildfire, this growth of grasses, forbs and some brush would result in a low-intensity surface fire. The majority of the vegetation in the mixed conifer ecosystem would survive a low-intensity fire. In some cases, enough grass could grow into the stand to change the fuel model to one with more fine fuels which would have a moderate to high rate of spread, but low flame lengths. Low intensity fires would result in low resistance to control, allowing fire fighters to directly attack the fire.

Within all proposed treatment areas, healthy fire-resilient dominant and co-dominant overstory trees would be retained. Overstory trees would consist primarily of shade intolerant species Jeffrey pine, and sugar pine where it currently exists. Some stands would have a mix of pine with red fir, white fir and/or incense cedar. Some trees in the mid-story and understory would be retained where they are healthy well-growing trees that are isolated from serving as ladder fuels. Some wildlife stands would have more of the smaller trees in the understory retained as part of the required habitat conditions.

Hand Thinning

There are approximately 4,942 acres of hand thinning units. Hand thinning would treat stands that are at moderate to heavy densities and have large areas of continuous surface, ladder, and canopy fuels. The treatments would generally remove lodgepole pine, white fir, red fir and incense cedar in the understory. Stands would be thinned to 70 trees per acre (TPA) or 100 TPA depending on slope and other factors such as existing insects, disease, or dwarf mistletoe. Prescribed hand pile and burning would be conducted in most hand thinned stands post thinning to remove remaining surface fuels in excess of desired levels of 10 to 15 tons per acre. Desired predicted stand level fire type for all hand thinned stands would be an S (Surface) fire type.

Approximately 1,550 acres of the hand thinning stands are located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas. The number of residual trees per acre was modified in each instance to maintain as much of the desired habitat conditions as possible (such as existing canopy cover in PACs). The residual trees generally ranged between 70 to 160 TPA.

Surface Fuel Loads

Effects of hand thinning and pile burning on surface fuel loads would be an overall reduction of fuel loads in all size classes. Total fuel loads would be reduced by about 48%. Approximately 4,251 acres, or 86%, of the hand thinned stands are predicted to meet desired conditions with levels that are at or below the desired maximum of 15 tons per acre post treatment (Table 3-7). All hand thinning stands were modeled (using FFE) using 90% reduction of surface fuels. The remaining 691 acres above the desired 15 tons per acre are due to the current (previous to treatment) fuel loads remaining high with the 90% modeled reduction. In all hand thinning stands outside of wildlife areas, prescribed pile burning would incorporate all fuels necessary to reduce fuels to less than 15 tons per acre. Most of the residual fuels would be that of the larger sizes classes left for wildlife and soil coverage purposes. Stands with greater than 10 tons per acre would usually be in the wildlife stands.

Areas where access is available and slopes are less than 30%, chipping or masticating of surface fuels instead of hand piling and burning, would occur. Approximately 353 acres have been identified for chipping or masticating within hand thin units. With chipping or mastication, the fuels are not reduced as would be with piling and burning, but are decreased in size and redistributed throughout the stand. Chipping or mastication of fuels decreases vertical fuel depth and redistributes the overall fuel load. Fire intensity and severity may still remain high however if fuel loads are too heavy, thereby causing fire to remain as a surface fire, but increasing duration and potentially the flame lengths. Under more severe weather conditions mastication has been shown to not reduce fireline intensities and tree mortality. Chipping or masticating hand thinned stands or portions of hand thinned stands would occur only where post treatment fuel loads would meet desired conditions.

Table 3-7. Fuels current and post treatment values

Current Conditions	Ave tons per acre	% Acres with < 15 tons/acre	Post-treatment	Ave tons per acre	% Acres with < 15 tons/acre
Hand Thin -70*	22	25	Hand Thin – 70*	10	96
Hand Thin - 100**	17	19	Hand Thin – 100**	9	100
Hand Thin - WL***	27	1	Hand Thin – WL***	13	73

* Stands thinned to 70 trees per acre
** Stands thinned to 100 trees per acre
*** Wildlife stands

Stands treated with hand thinning are often limited in meeting desired stand conditions or retaining them for long periods of time. Stands with higher residual densities and trees infected with dwarf mistletoe or other insects and diseases, are more likely to have higher increases in surface fuels over time. Approximately 2,131 acres, or 43%, would be above the desired fuel loads after 10 years post treatment. The other half of the hand thin stands (mostly stands thinned to 70 TPA) would however, meet desired conditions of fuel loads, with less than 15 tons per acre for over 10 years (Table 3-8).

Table 3-8. Fuels treatment values after 10 and 20 years

10 years Post-treatment	Ave tons per acre	% Acres with < 15 tons/acre	20 years Post-treatment	Ave tons per acre	% Acres with < 15 tons/acre
Hand Thin-70	15	66	Hand Thin-70	22	41
Hand Thin- 100	15	33	Hand Thin- 100	21	0
Hand Thin - WL	18	35	Hand Thin - WL	25	9

Overall fire behavior and expected fire type would be influenced in part by the amount, size, and distribution of surface fuels. All hand thinned stands with post treatment of activity fuels would help alter the predicted fire type to be that of lower intensity and severity.

Stand Level - Predicted Fire Type

Effects of hand thinning and fuels treatment on predicted fire types would be an overall increase in the acres of S (Surface) fire and decrease of A (Active), P (Passive), and C (Conditional), fire types. Total acres meeting the desired condition of having a predicted fire type of (S) Surface, would be approximately 4,325 acres, or 88% of the stands, post treatment (Table 3-9).

Because of the higher densities of residual trees within wildlife stands, including understory trees, there would have fewer acres changing from a predicted fire type of C (Conditional) to the desired fire type of S (Surface) (Table 3-9).

Table 3-9. Fire type current and post treatment values

Current Conditions	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Hand Thin-70	2,077	144	631	163
Hand Thin- 100	150	0	63	0
Hand Thin - WL	542	0	757	251
TOTAL	2769	144	1451	414
Post-treatment				
Hand Thin-70	3,006	0	10	0
Hand Thin- 100	159	0	54	0
Hand Thin - WL	1,106	0	390	0
TOTAL	4,325	0	454	0

Over time, the hand thinned stands would recover in canopy closure and canopy bulk density which, along with other variables such as accumulation of surface fuels, would cause the predicted surface fire type to change to C (Conditional). None of the stands, however, were predicted to change to P (Passive) or A (Active). See Table 3-10 below for expected fire types after 10 and 20 years.

Table 3-10. Fire type treatment values after 10 and 20 Years

10 years Post-treatment	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Hand Thin-70	3,006	0	10	0
Hand Thin- 100	159	0	54	0
Hand Thin - WL	898	0	652	0
TOTAL	4063	0	716	0
20 years post-treatment				
Hand Thin-70	2,949	0	67	0
Hand Thin- 100	159	0	54	0
Hand Thin - WL	710	0	839	0
TOTAL	3,818	0	960	0

Stands treated with hand thinning and prescribed burning would help shift the forests towards past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads, tree densities, and fuel ladders, thereby reducing the risk of high intensity wildfires. The time frame for lasting effects from hand thinning is less than mechanical. For about half of the hand thinning stands, the surface fuel loads are expected to be above the desired 15 tons per acre after 10 years post treatment. However, about 85% of the hand thinned stands are predicted to have stand-level fire types of desired S (Surface) for over 10 years.

Mechanical Thinning

Mechanical thinning treatments would treat 5,728 forested acres. Of those, 3,818 acres are using whole-tree logging system and 1,910 acres would be cut-to-length. Mechanical thinning treatments would treat stands that are of moderate to heavy densities and have large areas of continuous surface, ladder and canopy fuels. Mechanical thinning treatments would generally remove lodgepole pine, white fir, red fir, and incense cedar in the understory and some of the codominant trees in the overstory. Prescribed underburning would be conducted in 850 acres of the whole tree yarded stands post-thinning. Mechanical thinning and fuels reduction would be conducted in order to remove remaining surface fuels in excess of desired levels of 10 to 15 tons per acre. Desired predicted stand level fire type for all mechanically thinned stands would be an S (Surface) fire type.

Approximately 2,696 acres of stands are located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas. The residual trees per acre were modified in each instance to maintain as much of the desired habitat conditions as possible (such as existing canopy cover in PACs). This results in the wildlife areas having a higher average density than the other mechanical units.

Surface Fuel Loads

Effects of mechanical thinning and removal of surface fuels would be an overall reduction of fuel loads in all size classes. For the whole tree units, fuel loads would be reduced by about 80%. Approximately 65% of the whole tree units are expected to be below the desired maximum of 15 tons per acre (Table 3-11). The other 35% of the whole tree stands have higher predicted fuel loads. If necessary, prescribed burning or other methods of removal of activity fuels would occur in areas where post fuel levels are above the desired range.

The cut-to-length units would use mastication or chipping after thinning treatments and would therefore have a higher average of fuels post treatment. Instead of the surface fuels being consumed through fire or reduced through removal, they would be reduced in size and redistributed throughout the stand. Current and post treatment fuel loads would average about 20 to 25 tons per acre. Chipping or mastication of fuels decreases vertical fuel depth and redistributes the overall fuel load. Fire intensity and severity may still remain high however, if fuel loads are too heavy. The fire would remain as a surface fire, but have increasing duration and potentially, flame lengths. Under more severe weather conditions mastication has been shown to not reduce fireline intensities and tree mortality. If necessary, prescribed burning or other methods of removal in cut-to-length stands would occur where post treatment fuel loads are above desired conditions.

The wildlife areas would have the cut-to-length method of logging in about 25% of the stands and about 75% would be whole tree logging. The overall surface fuels would be reduced to about 14 tons per acre (Table 3-11).

Table 3-11 Fuels current and post treatment values

Current Conditions	Ave tons per acre	% Acres with < 15 tons/acre	Post-treatment	Ave tons per acre	% Acres with < 15 tons/acre
Cut-to-Length	25	9	Cut-to-Length	21	46
Whole Tree	19	45	Whole Tree	15	65
Mechanical- WL	25	20	Mechanical- WL	14	75

Stands with higher residual densities and trees infected with dwarf mistletoe or other insects and diseases, are more likely to have higher increases in surface fuels over time. The wildlife stands would have on average, higher stand densities thereby having a faster increase of accumulating surface fuels 10 and 20 years post treatment (Table 3-12). For all the mechanical stands, the average increase of fuels after the treatment for the following 20 years would be about 5 or 6 tons per acre.

Table 3-12. Fuels treatment values after 10 and 20 Years

10 years Post-treatment	Ave tons per acre	% Acres with < 15 tons/acre	20 years Post-treatment	Ave tons per acre	% Acres with < 15 tons/acre
Cut-to-Length	23	34	Cut-to-Length	24	34
Whole Tree	18	63	Whole Tree	20	58
Mechanical- WL	18	39	Mechanical- WL	23	23

Fire behavior and expected fire type would be influenced in part by the amount, size and distribution of surface fuels. All the mechanically thinned stands with post treatment of activity fuels would help alter the predicted fire type to be that of lower intensity and severity.

Stand Level - Predicted Fire Type

Effects of mechanical thinning and removal on predicted fire types would be an overall increase in the acres of S (Surface) fire and decrease of A (Active), P (Passive), and C (Conditional), fire types. Total acres meeting the desired condition of having a predicted fire type of (S) Surface would be approximately 4,888 acres, or 90% of the stands, post treatment (Table 3-13).

For the whole tree units, all but 8 acres would meet the desired condition of S (Surface) fire type. The cut-to-length units would meet the desired condition for all but 2 acres.

The wildlife areas would have the most amount of acres that are not predicted S (Surface) fire type. There would be about 541 acres of wildlife areas in the C (Conditional) condition (Table 3-13).

Table 3-13. Fire Type current and post treatment values

Current Conditions	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Cut-to-Length	414	241	130	268
Whole Tree	761	179	409	340
Mechanical- WL	842	317	999	538
TOTAL	2,017	738	1,538	1,146
Post Treatment				
Cut-to-Length	1052	2	0	0
Whole Tree	1680	0	8	0
Mechanical- WL	2155	0	541	0
TOTAL	4888	2	549	0

Over time, the mechanically thinned stands would recover in canopy closure and canopy bulk density which, along with other variables such as accumulation of surface fuels, would cause the predicted (S) Surface fire type to change. Mechanical thinning may also open stands enough to allow for natural regeneration to become established. If not treated, the seedlings become ladder fuels as they grow taller in the understory. The predicted fire types may then change from S (Surface) fire to C (Conditional), or P (Passive). None of the stands, however, were predicted to change to A (Active). See below for stand conditions and expected fire types after 10 and 20 years.

Table 3-14. Fire Type treatment values after 10 and 20 years

10 years Post-treatment	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Cut-to-Length	932	88	34	0
Whole Tree	1,580	108	0	0
Mechanical- WL	1,790	69	837	0
TOTAL	4,302	265	871	0
20 years Post-treatment				
Cut-to-Length	994	17	43	0
Whole Tree	1,688	0	0	0
Mechanical- WL	1,698	0	998	0
TOTAL	4,381	17	1,041	0

Stands treated with mechanical thinning and fuels treatment would help shift the forests towards past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads, tree densities, and fuel ladders, thereby reducing the risk of high intensity wildfires. Given the predicted fuel load levels and other expected stand conditions, about 80% of the mechanical thinning stands are predicted to meet desired stand-level fire type conditions for over 20 years after treatment.

Condition Class

The expected result under Alternative 2 is for Condition Class within the treatment areas to change from a Condition Class 2 or 3 toward Condition Class 1 or 2. Implementation of treatment prescriptions would also increase the likelihood that prescribed fire could be used for vegetation management inside the project area in the future.

Prescribed Fire and Pile Burning

Prescribed fire would have effects on vegetation species within the South Shore project area. Underburning would result in some mortality of white fir, incense cedar, and Douglas-fir seedlings. The low-intensity ground fire would also result in some mortality of sugar pine seedlings/saplings. Fire would prune trees, thereby raising the crown base height. Prescribed fire would also reduce surface and ladder fuels. Machine and hand pile burning would not have the same effects as underburning. Pile burning would not raise the heights of the crowns. There could be some scorching of low branches due to heat and flames from burning piles, but this would occur only in isolated patches.

In some areas of the South Shore Project, hand piling is the only available method for surface fuel treatment where sensitive soils, steep or rocky terrain, or lack of road access prohibit mechanical treatment. Handpile burning may scorch crown and cambium (living tissue underneath the bark) on nearby residual trees, and may result in mortality of individual or isolated pockets of trees. Due to the amount of trees to be thinned, the number and size of hand piles adjacent to residual trees in the stand increases the possibility for tree mortality as a result of pile burning; however, mortality as a result of hand pile burning would be light. Generally, mortality up to about15% of the residual trees in the stand may occur as a result of prescribed burning. Understory vegetation would not be affected, with the exception of localized areas where duff and litter would be consumed during hand pile burning. In these localized areas, the understory vegetation would regenerate, and the effects would be short term. Based on previous experience with hand piles that have been burned in the Lake Tahoe Basin, this effect is expected to be incidental on the stand level. Establishment of understory vegetation may be dependent on consumption of the surface fuels (primarily the duff and litter layers), canopy cover, and stand characteristics mentioned above. Low-intensity prescribed fire is expected to create negligible shifts in forest species composition and structure.

Fire Behavior

On a landscape level under 90^{th} percentile weather conditions, implementation of Alternative 2 would be expected to result in flame lengths less than four feet for a wildfire coming from an outside point or initiating in treated areas.

Fuels treatments similar to Alternative 2 have proven to be successful in modifying fire behavior. A good example is the Angora Fire, which started on June 24, 2007 and burned 3,110 acres within the Lake Tahoe Basin Management Unit, including approximately 1800 acres within stands originally scheduled for fuel treatment within the South Shore project area. When the Angora Fire started, fuel moisture and weather conditions were at levels expected to produce extreme fire behavior (97%). Prior to the Angora Fire, 480 acres within the Angora Fire area received commercial and or precommercial mechanical thinning, followed by hand thinning on steeper slopes and piling and burning. Following the fire, stand data was collected on both treated and non-treated units where fire had occurred. The objectives for the data collection and analysis were to, 1) quantify the differences in fire severity between the treated and non-treated areas, and 2) evaluate the effectiveness of the treatments and their potential use for future fuel reduction projects on the forest. The thinned areas survived with an estimated 20% mortality, while the adjacent unthinned area experienced 100% mortality. In addition, approximately 405 acres of the fuel treatments burned as a surface fire while 75 acres burned as a crown fire. These areas were all on the same aspect and slope (An assessment of Fuel treatment Effects on Fire Behavior, Suppression Effectiveness, and Structure Ignition on the Angora Fire, 2007).

Other evidence exists that support the effectiveness of open stands with fewer trees as being the most desirable result of effective fuel treatment. Graham and McCaffrey (2003) documented the effects of the Hayman Fire (Colorado, June 2002) on stands that were thinned from below. The results were very similar to that reported with the Cone Fire thinning. Tree density reduction resulted in an easily suppressed surface fire when the Hayman and Cone fires burned into treated stands. Thinning decreases canopy cover in stands and has the potential to increase solar radiation and wind movement through the stand, resulting in warmer temperatures and drier fuels that enhance surface fire to spread. However, thinning does make surface fires easier to control because fire line can be constructed by hand with direct attack suppression techniques, allowing for a safer environment for firefighters on the ground.

For the South Shore project, results of models run on a landscape level for predicted fire behavior is shown in Table 3-15 Results demonstrate that the reduction of surface fuels, reducing CBD, and raising CBH moderates surface and crown fire behavior. Reducing surface fuels also changes fire type from passive crowning to surface fires in many of the stands.

Under Alternative 2 average CBH would range from 12 to 38 ft. The lowest CBH of 12 feet is considered to be relatively effective from a fire management perspective. Another benefit for managing wildfire with Alternative 2 is that CBD is expected to range between 0.04 to 0.167 kg/m3, which is lower than, or approximating, the 0.10 kg/m3 CBD threshold for predicting crown fire initiation (Agee 1996).

Table 3-15. Fire types for hand, mechanical, and wildlife PACs, post treatment and 2 decades with implementation of Alternative 2

Alternative 2 Post-treatment	Fire Type Surface	Fire Type Passive Crown	Fire Type Conditional Crown	Fire Type Active Crown
Hand Treatment Stands	99%	0%	01%	0%
Mechanical Treatment Stands	99%	01%	0%	0%
Wildlife (PAC) Stands	76%	0%	23%	0%
All Stands	92%	0%	8%	0%
10 Years				
Hand Treatment Stands	99%	0%	01%	0%
Mechanical Treatment Stands	88%	10%	03%	0%
PAC Stands	63%	02%	36%	0%
All Stands	83%	4%	13%	0%
20 Years				
Hand Treatment Stands	99%	0%	01%	0%
Mechanical Treatment Stands	97%	01%	03%	0%
PAC Stands	52%	0%	48%	0%
All Stands	83%	0%	17%	0%

Alternative 3

Alternative 3 would reduce fuels over fewer acres than under Alternative 2, but is effective in changing fire behavior across the landscape and achieving the desired surface fire and rate of spread that would allow direct suppression attack to protect neighborhoods and communities. Alternative 3 was developed to reduce negative environmental effects while providing similar benefits for fuel reduction and changes in fire behavior as Alternative 2, and the same discussions of those effects would apply.

Direct Effects

Hand Thinning

For Alternative 3, hand thinning treatments would be applied on 5,987 forested acres. Approximately 1,962 acres of those stands are located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas. The current and post treatment conditions for stand-level fuel loads and predicted fire type are similar to Alternative 2. Differences are mainly the changes in acres treated with the different treatment types.

Surface Fuel Loads

Total fuel loads would be reduced by about 49%. Approximately 5,289 acres, or 91%, of the hand thinned stands are expected to meet desired conditions with levels that are at or below the desired maximum of 15 tons per acre post treatment (Table 3-16). The remaining 698 acres above the desired 15 tons per acre are due to the current (previous to treatment) fuel loads remaining high with the 90% modeled reduction.

Approximately 692 acres have been identified for chipping or masticating within hand thin units. Chipping or masticating hand thinned stands or portions of hand thinned stands would only occur where post treatment fuel loads would meet desired conditions.

Table 3-16. Fuels current and post treatment values

Current Conditions	Ave tons per acre	% Acres with < 15 tons/acre	Post Treatment	Ave tons per acre	% Acres with < 15 tons/acre
Hand Thin -70*	22	25	Hand Thin -70*	10	96
Hand Thin - 100**	22	31	Hand Thin - 100**	13	95
Hand Thin - WL***	28	0	Hand Thin - WL***	14	82

* Stands thinned to 70 trees per acre
** Stands thinned to 100 trees per acre
*** Wildlife stands

Stands treated with hand thinning are often limited in meeting desired stand conditions or retaining them for long periods of time. Stands with higher residual densities and trees infected with dwarf mistletoe or other insects and diseases, are more likely to have higher increases in surface fuels over time. Approximately 2,456 acres, or 42%, would be above the desired fuel loads after 10 years post treatment. The other portion of the hand thin stands (mostly stands thinned to 70 TPA) would however, meet desired conditions of fuel loads less than 15 tons per acre for over 10 years (Table 3-17).

Table 3-17. Fuels treatment values after 10 and 20 years

10 years Post Treatment	Ave tons per acre	% acres with < 15 tons/acre	20 years Post Treatment	Ave tons per acre	% acres with < 15 tons/acre
Hand Thin -70	15	68	Hand Thin -70	21	38
Hand Thin - 100	18	49	Hand Thin - 10	23	18
Hand Thin - WL	19	43	Hand Thin - WL	26	10

Overall fire behavior and expected fire type would be influenced in part by the amount, size, and distribution of surface fuels. All hand thinned stands with post treatment of activity fuels would help alter the predicted fire type to be that of lower intensity and severity.

Stand Level - Predicted Fire Type

Effects of hand thinning and fuels treatment on predicted fire types would be an overall increase in the acres of S (Surface) fire and decrease of A (Active), P (Passive), and C (Conditional), fire types. Total acres meeting the desired condition of having a predicted fire type of S (Surface) would be approximately 5,224 acres post treatment (Table 3-18). Because of the higher densities of residual trees within wildlife stands, including understory trees, they would have fewer acres changing from a predicted fire type of C (Conditional) to the desired fire type of S (Surface).

Table 3-18. Fire type current and post treatment values

Current Conditions	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Hand Thin-70	2,133	243	619	314
Hand Thin- 100	104	0	313	110
Hand Thin - WL	554	48	1,042	319
TOTAL	2,791	291	1,974	743
Post-treatment				
Hand Thin-70	3,288	0	22	0
Hand Thin- 100	505	0	21	0
Hand Thin - WL	1,431	0	531	0
TOTAL	5,224	0	574	0

Over time, the hand thinned stands would recover in canopy closure and canopy bulk density which, along with other variables such as accumulation of surface fuels, would cause the predicted surface fire type to change to C (Conditional). None of the stands, however, were predicted to change to P (Passive) or A (Active). See Table 3-19 below for expected fire types after 10 and 20 years.

Table 3-19. Fire type treatment values after 10 and 20 years

10 Years Post-treatment	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Hand Thin-70	3301	0	9	0
Hand Thin- 100	434	0	92	0
Hand Thin - WL	1115	0	847	0
TOTAL	4,850	0	948	0
20 Years Post-treatment				
Hand Thin-70	3,215	0	94	0
Hand Thin- 100	280	0	246	0
Hand Thin - WL	899	0	1064	0
TOTAL	4394	0	1403	0

Stands treated with hand thinning and prescribed burning would help shift the forests towards past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads, tree densities, and fuel ladders, thereby reducing the risk of high intensity wildfires. The time frame for lasting effects from hand thinning is less than mechanical. For about half of the hand thinning stands, the surface fuel loads are expected to be above the desired 15 tons per acre after 10 years post treatment. However, about 80% of the hand thin stands are predicted to have stand-level fire types of desired S (Surface) for over 10 years.

Mechanical Thinning

Mechanical thinning treatments would treat 4,151 forested acres. Of those, 2,141 acres are using whole-tree logging system and 2,010 acres would be cut-to-length. Prescribed underburning would be conducted in 774 acres of the whole tree yarded stands post-thinning. Mechanical thinning and fuels reduction would be conducted in order to remove remaining surface fuels in excess of desired levels of 10 to 15 tons per acre. Desired predicted stand level fire type for all mechanically thinned stands would be an S (Surface) fire type. Approximately 1,728 acres of stands are located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas.

The current and post treatment conditions for stand level fuel loads and predicted fire type are similar to Alternative 2. Differences are mainly the changes in acres treated with the different treatment types.

Surface Fuel Loads

For the whole tree units, fuel loads would be reduced by 67%. Approximately 82% of the whole tree units are expected to be below the desired maximum of 15 tons per acre (Table 3-20). The other 18% of the whole tree stands would have higher fuel loads ranging from about 15 to 25 tons per acre.

The wildlife areas would have the cut-to-length method of logging in about 50% of the stands and the other half would be whole tree logging. The overall surface fuels would be reduced to about 15 tons per acre (Table 3-20).

Table 3-20. Fuels current and post treatment values

Current Conditions	Ave tons per acre	% acres with < 15 tons/acre	Post-treatment	Ave tons per acre	% acres with < 15 tons/acre
Cut-to-Length	21	10	Cut-to-Length	20	49
Whole Tree	18	47	Whole Tree	12	82
Mechanical- WL	25	16	Mechanical- WL	15	61

Stands with higher residual densities and trees infected with dwarf mistletoe or other insects and diseases, are more likely to have higher increases in surface fuels over time. The wildlife stands would have on average, higher stand densities thereby having a faster increase of accumulating surface fuels 10 and 20 years post treatment (Table 3-21). For all the mechanical stands, the average increase of fuels after the treatment for the following 20 years would be about 5 tons per acre.

Table 3-21. Fuels treatment values after 10 and 20 years

10 years Post Treatment	Ave tons per acre	% acres with < 15 tons/acre	20 years Post Treatment	Ave tons per acre	% acres with < 15 tons/acre
Cut-to-Length	19	38	Cut-to-Length	19	34
Whole Tree	17	78	Whole Tree	19	75
Mechanical- WL	19	31	Mechanical- WL	24	19

Fire behavior and expected fire type would be influenced in part by the amount, size and distribution of surface fuels. All the mechanically thinned stands with post of activity fuels would help alter the predicted fire type to be that of lower intensity and severity.

Stand Level - Predicted Fire Type

Effects of mechanical thinning and removal on predicted fire types would be an overall increase in the acres of S (Surface) fire and decrease of A (Active), P (Passive), and C (Conditional), fire types. Total acres meeting the desired condition of having a predicted fire type of S (Surface), would be approximately 3,474 acres, or 89% of the stands, post treatment (Table 3-22).

All of the whole tree units would meet the desired condition of S (Surface) fire type. The cut-to-length units would meet the desired condition for all but 2 acres. The wildlife areas would have the most amount of acres that are not predicted S (Surface) fire type. There would be about 414 acres of wildlife areas in the C (Conditional) condition (Table 3-22).

Table 3-22 Fire type current and post treatment values

Current Conditions	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Cut-to-Length	431	164	119	170
Whole Tree	716	151	168	242
Mechanical- WL	442	313	656	317
TOTAL	1589	628	944	729
Post-treatment				
Cut-to-Length	883	2	0	0
Whole Tree	1277	0	0	0
Mechanical- WL	1314	0	414	0
TOTAL	3474	2	414	0

Over time, the mechanically thinned stands would recover in canopy closure and canopy bulk density which, along with other variables such as accumulation of surface fuels, would cause the predicted Surface fire type to change. Mechanical thinning may also open stands enough to allow for natural regeneration to become established. If not treated, the seedlings become ladder fuels as they grow taller in the understory. The predicted fire types may then change from S (Surface) fire to C (Conditional), or P (Passive). One of the wildlife stands is predicted to change to A (Active) after approximately 10 years. Depending on ladder fuels, such as with heights of understory trees, and branches on understory and overstory trees, the stand would be changed back to a C (Conditional) fire type after 20 years. See below for stand conditions and expected fire types after 10 and 20 years (Table 3-23).

Table 3-23. Fire type treatment values after 10 and 20 years

10 Years Post Treatment	Severe FT S (acres)	Severe FT P (acres)	Severe FT C (acres)	Severe FT A (acres)
Cut-to-Length	744	88	53	0
Whole Tree	1277	0	0	0
Mechanical- WL	1064	17	592	56
TOTAL	3085	105	645	56
20 Years Post-treatment				
Cut-to-Length	809	17	58	0
Whole Tree	1277	0	0	0
Mechanical- WL	1077	0	652	0
TOTAL	3163	17	710	0

Stands treated with mechanical thinning and fuels treatment would help shift the forests towards past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads, tree densities, and fuel ladders, thereby reducing the risk of high intensity wildfires. Given the predicted fuel load levels and other expected stand conditions, about 80% of the mechanical thinning stands are predicted to meet desired stand level fire type conditions for 20 years after treatment.

For Alternative 3, results of models run on a landscape level for predicted fire behavior (Table 3-24) is similar to Alternative 2 and results ran on a stand by stand level described above. Results demonstrate that the reduction of surface fuels, reducing CBD, and raising CBH moderates surface and crown fire behavior. Reducing surface fuels also changes fire type from passive crowning to surface fires in many of the stands.

Table 3-24. Fire Types for hand, mechanical, and wildlife PACs, post treatment and 2 decades with implementation of Alternative 3

Post-treatment	Fire Type Surface	Fire Type Passive Crown	Fire Type Conditional Crown	Fire Type Active Crown
Hand Treatment Stands	98%	0%	03%	0%
Mechanical Treatment Stands	100%	01%	0%	0%
Wildlife (PAC) Stands	74%	0%	26%	%
All Stands	90%	0%	10%	0%
10 Years				
Hand Treatment Stands	96%	0%	05%	0%
Mechanical Treatment Stands	92%	05%	03%	0%
PAC Stands	59%	01%	39%	2%
All Stands	82%	2%	15%	1%
20 Years				
Hand Treatment Stands	80%	0%	21%	0%
Mechanical Treatment Stands	96%	01%	04%	0%
PAC Stands	54%	0%	46%	0%
All Stands	77%	0%	24%	0%

Differences for Alternative 3 are displayed in the tables below.

Table 3-25. Fire types for hand treatments under Alternative 3 by tree spacing or wildlife PAC, post-treatment and 2 decades

Post-hand Treatment	Fire Type			
	Surface	Passive Crown	Conditional Crown	Active Crown
Hand Thin 70 trees/acre	100%	0	<01%	0
Hand Thin 100 trees/acre	96%	0	04%	0
Hand Thin Wildlife PAC	72%	0	28%	0
All Stands	90%	0	10%	0
10 Years				
Hand Thin 70 trees/acre	100%	0	<01%	0
Hand Thin 100 trees/acre	91%	0	09%	0
Hand Thin Wildlife PAC	57%	0	43%	0
All Stands	84%	0	16%	0
20 Years				
Hand Thin 70 trees/acre	97%	0	03%	0
Hand Thin 100 trees/acre	62%	0	38%	0
Hand Thin Wildlife PAC	46%	0	54%	0
All Stands	76%	0	24%	0

Table 3-26. Fire types for mechanical treatment under Alternative 3 by type and wildlife PAC, post-treatment and 2 decades

Post-mechanical Treatment	Fire Type			
	Surface	Passive Crown	Conditional Crown	Active Crown
CTL	100%	<01%	0	0
WT	100%	0	0	0
PAC	76%	0	24%	0
All Stands	89%	<01%	11%	0
10 Years				
CTL	84%	10%	06%	0
WT	100%	0	0	0
PAC	61%	01%	35%	03%
All Stands	79%	03%	17%	01%
20 Years				
CTL	91%	02%	07%	0
WT	100%	0	0	0
PAC	62%	0	38%	0
All Stands	81%	01%	18%	0

Effects Comparison by Alternative

Both action alternatives would have about the same residual average densities after either hand or mechanical thinning, including the wildlife stands. Alternative 2 would treat more acres within the project area than Alternative 3 and more acres would be mechanically thinned rather than hand thinned. The results on flame length and rate of spread is shown below in Tables 3-27 and 3-28.

Table 3-27. Flame length by alternative

Alternatives	Flame Length <4 feet	Flame Length > 4 feet	Percent Change to < 4 feet
Alternative 1	2,634 acres	7,742 acres	0%
Alternative 2	6,525 acres	1,528 acres	148 %
Alternative 3	6,416 acres	3,722 acres	144 %

Table 3-28. Rate of Spread**

Alternative	Average Rate of Spread (chains/hour)	Percent Change
Alternative 1	104 ch/hr	0 %
Alternative 2	129 ch/hr	24 % ch/hr
Alternative 3	247 ch/hr	137 % ch/hr

** Rate of spread is calculated over the project treatment area**

While the rate of spread has increased for the action alternatives, due to opening of the canopy and modeled fuel type change, the change is negligible due to lower flame lengths and surface fire type which increase the capability of firefighters.

The increase in hand thinning with Alternative 3 would result in a slightly higher average fuel load than the hand thinning in treatments in Alternative 2. However the number of acres meeting desired conditions of fuel loads less than 15 tons per acre and predicted stand level fire type of S (Surface) is the same for both alternatives (Table 3-29).

With Alternative 3, the increase in fuel loads is reflected within the wildlife stands as well. The average percent of acres meeting the less than 15 tons per acre is less.

There is also a slight decrease in the amount of acres meeting the desired predicted fire type of S (Surface).

With Alternative 3, the mechanically thinned stands have a 10% increase of area meeting the desired condition for fuel load. Both alternatives meet desired condition for predicted stand level fire type for all areas treated (Table 3-29).

Table 3-29. Summary of alternatives

Alternative	No Treatment	Hand Thin Stands	Mechanical Thin Stands	Wildlife Stands
1 No Action Alternative	Acres	3,392	3,032	4,246
	Ave Tons/Acre	21	23	25
	Ave % <15 T/A	28	27	20
	% Fire Type S	85	38	35
Post Treatment				
2 Proposed Action	Acres	3,392	3,032	4,246
	Ave Tons/Acre	10	18	14
	Ave % <15 T/A	96	56	74
	% Fire Type S	98	100	78
3 Alternative	Acres	4,025	2,423	3,690
	Ave Tons/Acre	12	16	15
	Ave % <15 T/A	96	66	72
	% Fire Type S	98	100	74

Compared to Alternative 1 (no action) both action alternatives greatly increase the overall number of acres meeting the desired fuels condition of having less than the maximum level of 15 tons per acre. Both action alternatives also greatly increase the percent of acres meeting the predicted stand level fire type of S (Surface). The greater number of acres treated and greater reduction in both stand densities and fuel loads would result in a greater shift toward desired forest conditions throughout the project area.

Cumulative Impacts

Alternative 1 (No Action)

The cumulative impact of the No Action alternative in combination with existing fuel treatments would be that there would be no increase in the overall effectiveness of existing fuel reduction treatments on the landscape scale. However the continuing fuel build up under Alternative 1 may reduce the effectiveness of existing fuel treatments because the existing fuel treatments do not meet the Forest Plan objectives for the WUI to reduce fire intensity across the Defense Zone.

Alternative 2 (Proposed Action) and Alternative 3

The cumulative impact of both of the action alternatives in combination with the existing fuel treatments would be to increase the overall effectiveness of existing fuel reduction on the landscape scale. Differences in cumulative effects between the action alternatives are negligible.

The fuel treatments under both action alternatives would combine with existing treatments to create a relatively open forest structure where fuel amounts and arrangements have been altered to encourage low-intensity surface fires, which may be effectively suppressed by fire management personnel. See Map 9 for location of potential crown fire activity post-treatment. The intensity and frequency of fuel treatment maintenance activities may have an inherent effect on the establishment and development of understory vegetation and tree regeneration. This, in turn, would retain stand structure and composition and would positively influence the long term effectiveness of fuel treatments in terms of understory establishment and development.

B. Forest Vegetation

Scope of the Analysis, Indicators, and Issues

This analysis is based on field reconnaissance of the project area beginning in fall of 2005 and a variety of data sources including IKONOS imagery and GIS data. Current and post-treatment stand conditions are based on treatment modeling using the West Side Sierra Nevada variant of the Forest vegetation simulator (FVS) (USDA FS 2006).

The FVS program is a model for predicting forest stand dynamics. FVS projections used project area stand inventory data. The effects of the proposed treatments are based on FVS projections of stands with inventory data and are representative of average stand conditions. The modeling in this section reflects projected forest vegetation conditions, without the influence or effects of wildfire. (For fire behavior modeling, see previous fire and fuels section.)

Stands are identified and analyzed based on three types of treatments: 1.) mechanical treatments, 2.) hand treatments, and 3.) treatments emphasizing wildlife. Stands for mechanical treatment have slopes less than 30% and access is available for ground-based equipment to fall and remove the trees. Hand thinning stands are primarily those over 30% slope and would be treated manually using chainsaws to fall the trees, and hand piling of the activity fuels. Wildlife stands have prescriptions specifically designed for the type of wildlife and habitat that is located in the stand, and have both mechanical and hand thinning treatments. The proposed treatment prescriptions are described in Chapter 2.

Existing Conditions

The South Shore project analysis area consists of a variety of conifer forest types as well as aspen stands, meadows, and stream environment zones. The conifer forested areas consist primarily of the mixed conifer type and Jeffrey pine (Table 3-30). Lodgepole pine occupies areas near streams and meadows, while red fir and subalpine conifers are found in the higher elevations (Map 11).

Table 3-30. Project Area Existing Vegetation

Existing Vegetation	Acres
Forest	
Mixed Conifer	16,195
Jeffrey Pine	15,348
Lodgepole Pine	6,522
Red Fir	8,870
Subalpine Conifers	7,747
Misc/Other Pine	1,037
Hardwood Forest/Woodland	497
Non-forest	
Shrub	14,133
Herbaceous	4,629
Barren	7,223
Urban	2,068
Water	2,540

Cover Types

The Jeffrey Pine forest type occurs above 6,200 ft, and is characterized by Jeffrey Pine throughout the overstory with some, sugar pine, incense cedar, lodgepole pine, western juniper, white fir, and western white pine (*Pinus monticola*). The dominant understory shrubs may include greenleaf manzanita, huckleberry oak, and tobacco brush.

The mixed conifer forest type occurs within an elevation range of 6,300-7,000 ft, and is characterized by white fir (*Abies concolor*) throughout the overstory. Other overstory components include Jeffrey pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), incense-cedar (*Calocedrus decurrens*), red fir (*Abies magnifica*), lodgepole pine (*Pinus contorta*) and western juniper (*Juniperus occidentalis*). Dominant understory shrubs include tobacco brush (*Ceanothus velutinus*), greenleaf manzanita (*Arctostaphylos patula*), huckleberry oak (*Quercus vaccinfolia*), snowberry (*Symphoricarpos* spp.), and squaw carpet (*Ceanothus prostrata*).

Approximately 466 acres of red fir forest type exist as an inclusion in the mixed conifer series. The majority of red fir stands are located in higher elevations, between 7,000 and 9,000 feet.

Existing streamside vegetation in the project area is often dominated by lodgepole pine, with black cottonwood (*Populus trichocarpa*), willows (*Salix* spp.), or alder (*Alnus* spp.). White fir and Jeffrey pine also grow in the overstory. A mix of small white fir, shrubs, and herbaceous species typically composes the understory.

The aspen/meadow community type includes aspen stands and mountain meadows. Although aspen dominates these stands, willows are common in the understory. Meadows are composed of a mix of various grasses, sedges, forbs, and scattered willows. Currently there are aspen stands where aspen appear to be in decline, with the aspen overtopped by conifers, or conifer encroachment is occurring.

Stand Composition, Structure and Density

The current forest conditions developed following Comstock-era logging (1880 to 1920) and in the absence of the most prevalent historic disturbance regime, fire. Prior to the early 1900s, when effective fire suppression began, fire was essential to keeping stands open and minimizing shrubs and ground fuels. The forests were dominated by widely spaced, large-diameter trees, such as Jeffrey pine, with sugar pine occurring in some areas. Past tree densities are estimated to average about 120 per hectare, or 50 trees per acre (USDA Forest Service LTBMU 2004). These are conditions described in the Fire and Fuels section above as Condition Class 1, where ecosystems are intact and functioning within historical parameters and fire frequency is at naturally occurring levels. Open stands dominated by larger trees with relatively few scattered understory trees and regeneration are conditions that support low to moderate intensity ground fires.

In the absence of fire, shade-tolerant species such as white fir have crowded the understory and become a dominant component of the overstory. The resulting overstory is also much denser in the absence of fire, resulting in trees that are less vigorous and more susceptible to insects, diseases, and drought. Most stands are currently considered Condition Class 2 or 3, where ecosystems have been moderately to significantly altered from their historical range. Please refer to the previous Fire and Fuels section for more details on existing conditions for fuels and wildfire potential.

Stand exam plot data was collected within random plots distributed throughout the project area during the 2006 and 2007 field seasons. The data collected included tree species, diameters, and heights. The collected data was entered into the FVS program which then modeled current forest density conditions based on trees per acre (TPA), basal area, and stand density indices (SDI).

Existing stands have moderate to heavy densities and have large areas of continuous surface, ladder and canopy fuels. Stand exam data for the proposed treatment stands show that the average number of live trees per acre varies widely, with a range of between 50 to over 5,000 TPA.

Basal area is the cross sectional area of a tree bole measured at diameter at breast height (dbh). The average quadratic mean diameter of live trees ranges from as low as 3 inches dbh up to 34 inches dbh. Stand density is calculated as an average for the stand from the varying stand dbh measurements within the stand.

The stand density index (SDI) allows for a direct comparison of density between stands by creating a comparable index. SDI converts a stand’s current density into a density at a constant reference size of 10 inches dbh. An SDI of 400, for instance, would represent 400 TPA that are 10 inches at dbh, or 132 TPA that are 20 inches dbh. Different species tolerate different maximum stand densities. For instance, Jeffrey pine in the Lake Tahoe Basin, has a suggested maximum SDI of 410, where as white fir and red fir can persist at higher densities, with maximum SDIs of 750 and 800. However, these are maximum densities, and when stands reach densities that are between 60% and 70% of maximum SDI, they grow at increasingly slower rates as trees become stressed for resources such as soil nutrients, water, and sunlight.

Approximately 65 percent or 6,918 acres of the project area forest stands are at or above 60% of maximum SDI. Most of these stands have an average SDI ranging from 70% to over 100% of maximum. The overall average is at 93%. The desired stand densities for overall forest health objectives as measured in SDI would be about 40% of the maximum.

The overall average basal area for proposed treatment stands is about 200 ft^2 per acre, ranging from 150 to over 400 ft^2 per acre. Inter-tree competition is reducing stand growth and vigor at these densities. The desired basal areas, with a corresponding SDI, would range between approximately 100-150 ft^2 per acre. Trees are able to withstand drought conditions better when at lower stand densities with sufficient available growing space and resources and that inter-tree competition does not have a large effect on stand growth (Long 1985). Trees are therefore more vigorous and able to resist insect attacks and disease outbreaks (Fettig et al. 2007).

Forest Health

Precipitation is variable throughout the western United States, including the Sierra Nevada mountain range. Forest types also vary in their response to drought, with some vegetation types exhibiting greater tolerance for drought than other forest types. Within the Lake Tahoe Basin, and the South Shore analysis area, the pine-dominated vegetation types demonstrate a greater tolerance for drought than the true fir vegetation types. Jeffery, ponderosa, and sugar pines are the most drought-tolerant species, and concurrently are also the most fire-resistant species as well. The true firs, especially white fir, are the least drought-tolerant conifer species. As stand densities increase, water availability becomes a limiting factor for tree health, and during drought conditions, moisture stress and mortality increase, especially for species with low drought-tolerance.

Typically, widespread bark beetle attacks occur in dense stands in conjunction with drought conditions when trees are already under stress. There are a number of bark beetle species present and active within the project area including mountain pine beetle (*Dendroctonus ponderosae*) and Jeffrey pine beetle (*Dendroctonus jeffreyi*). They are primarily found in stands that have grown increasingly dense and are often associated with diseases also occurring in the stand.

Dwarf mistletoe (*Arceuthobium spp.*) infection occurs throughout the project area infecting both white fir and Jeffrey pine, with infection located in both overstory and understory trees. The level of infection varies from light to heavy and is measured by utilizing Hawksworth’s dwarf mistletoe rating system (1977). The live crown of a tree is divided into thirds and the numbers 0 (no infection), 1 (less than 50% infection), or 2 (50% infection or more) are assigned to each third of the tree, resulting in a maximum dwarf mistletoe rating (DMR) of 6. The stands infected with dwarf mistletoe are moderately dense to very dense, with susceptible host trees are in close proximity to one another allowing easier spread.

Annosus root disease is caused by the fungus *Heterobasidion annosum* and is found in all western conifer species, however true fir and pine are especially susceptible to infection (Schmitt et al. 2000). Annosus root disease spreads from root to root contact as well as from infection by airborne spores. Long distance spread can occur when airborne spores contact and infect fresh exposed wounds and stump surfaces (Schmitt, et al 2000). Once *H. annosum* occupies a site, it resides in the soil for up to 50 years as a saprophytic (an organism that obtains food from dead or decaying organic matter) agent. *H. annosum* is present in the South Shore project area, and infects the red and white fir species.

One or more of these insects and diseases may exist in each of the proposed treatment stands with varying levels of intensity and area of spread. Under existing conditions, with overly dense forest stands, mortality from insects and diseases has increased above normal or background levels. The desired condition would be for native insects and pathogens to function in their natural roles, existing at low levels of intensity within forest ecosystems. Under these normal or natural conditions, insects and diseases act as agents of diversity. They influence forest composition, structure and density by selectively killing or slowing the growth of some trees while affecting others to a lesser degree or not at all. They have important roles in creating small canopy gaps, specialized wildlife habitat, and are involved in nutrient recycling. They coexist with host plants with a reasonable balance that permits populations of each to survive.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

<u>Stand Composition, Structure and Density</u>

Under the No Action Alternative the desired stand density conditions would not be met. Effects include an increase in stand densities (Table 3-31) resulting in reduced growth and vigor and increased mortality. This would ultimately result in greater risk of higher intensity natural disturbances such as wildfire or insect and disease outbreaks.

With little or no disturbance, growth rates in stands near or above 60% of maximum SDI would continue to decrease, the overall health of trees would decline, and an increase in mortality would occur. Mortality of understory trees would increase due to competition, insects, or disease. Residual overstory trees would increase in size; however, selective bark beetle mortality of large diameter trees could cancel this effect and reduce the size class of stands. As stands reach and persist at maximum densities, they would remain at high risk of widespread mortality from insect and disease outbreaks and from wildfire (Ferrel 1986). Pockets of mortality due to insects, disease, windfall, or wildfire could create openings in stands and add to hazardous fuel. The stands that are currently more open would generally grow at faster rates due to less inter-tree competition, and growth rates would be dictated more by factors of site quality than stand density until they reach an SDI that would reduce their growth rates.

Table 3-31. Current and predicted stand densities

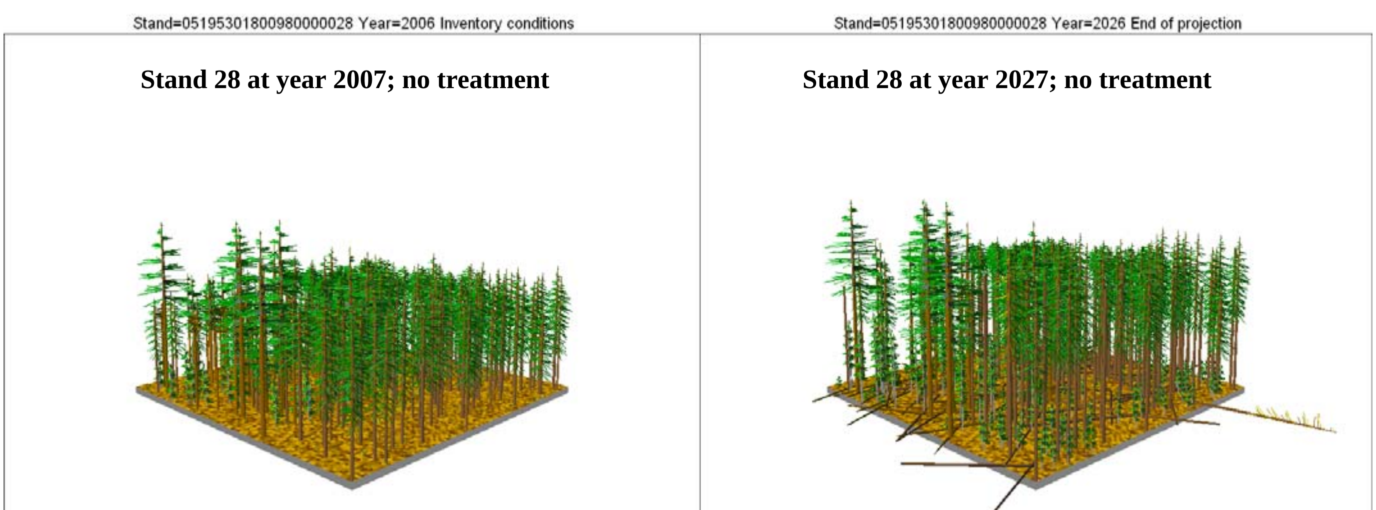
Treatment	Current Ave % Max SDI	Current Ave BA (ft2)	10 Years % Max SDI	10 Years Ave BA	20 Years % Max SDI	20 Years Ave BA
Hand Thin Stands	60	165	66	188	72	213
Mechanical Stands	97	209	106	250	115	284
Wildlife Stands	85	203	93	231	99	254

Using the FVS model, a representative stand was chosen for simulating resulting stand conditions over time with no treatment. The representative stand is a mixed conifer stand currently above maximum SDI level and would have high mortality occurring over the next 20 years, which would lower the trees per acre, but maintain SDI at 100% of maximum level. Basal area would also remain at a maximum level of about 378 square feet per acre. A summary of stand conditions in 10 and 20 years is shown below (Table 3-32).

Table 3-32. Stand summary conditions over 20 years

Year	TPA	BA	SDI	DMI	DM-TPA
2007	518	378	654	1.6	6
2017	417	379	628	1.6	15
2027	359	378	609	2.0	15

Dwarf mistletoe also exists in the stand, although at low levels, and the number of trees infected would increase over time as shown by the increasing DMI (discussed below). Average stand conditions of the modeled stand at current 2007 and projected to year 2027 are pictured below (Figure 3-6).



Source: USDA Forest Service, “Forest Vegetation Simulator”

Figure 3-6. Stand conditions at year 2007 and 2027 with no treatment

Under Alternative 1, stand composition would continue to shift toward an increasing component of shade tolerant species that are more adapted to persist at high densities.

Pine in existing stands would become increasingly susceptible to mortality as stand densities increase. Stands that have been previously thinned within the past 10-20 years would grow at faster rates and be less susceptible to density related mortality; however, they would also have an increasing component of shade tolerant trees as these species continue to establish and grow into the understory canopy. Pine regeneration would depend upon the creation of natural gaps such as wind-throw or pockets of bug kill that provide favorable light levels and seed bed conditions for the establishment and growth of pine seedlings. Natural disturbance could change stand structure, density, and size class distribution by creating openings and reducing the number of existing trees of various sizes and ages and increasing the amount of understory vegetation that may consist of tree regeneration or shrubs.

In Alternative 1, aspen stands would continue to decline as conifers, primarily lodgepole pine and white fir, continue to spread within aspen communities. The encroaching conifers are more shade tolerant than aspen and would continue to regenerate in the aspen meadows. As the encroaching conifers increase in growth they would out-compete the aspen stands for light resources. (Shepperd et al. 2006).

Forest Health

With the No Action alternative, dwarf mistletoe would continue to spread within the stand in most cases and could potentially spread outside the stand to adjacent forested areas. The level of infection would also continue to increase causing an increase in tree mortality.

The Mean DMI rating is the dwarf mistletoe rating for infected trees, as described above, averaged for a stand. The Mean DMI for stands that were modeled using FVS is about 3.5 with increases of about 0.7 over 20 years. The number of trees infected increased by an average of 40 trees per acre over 20 years, and the average percentage of infected trees within the stands increased by 13% over the same two decades. Overall mortality also increased by about 1 TPA per decade.

The risk of bark beetle outbreaks causing large-scale mortality in pines would increase over time as stands grow increasingly dense under Alternative 1. Stands at most risk in the project area are dense stands (60% of maximum SDI or more), especially during periods of extended drought (DeMars and Roettgering 1982, Ferrel 1986, Kegley et al. 1997, Smith 1971). Approximately 65 percent, or 6,918 acres, of the project area forest stands are at or above 60% of maximum SDI. With no treatment or major disturbance an additional 1,355 acres of forested stands, (a total of 8,273 acres), would reach or exceed 60% of maximum SDI for an average of over 78% of the project area in a densely stocked condition within 20 years. This would run counter to the desired condition of stands dominated by fire resistant pine in the overstory.

The risk of bark beetle outbreak would be considerably less in higher elevation true fir stands. However, because pine cannot survive at the higher densities that true fir can, and pine is a lesser component of higher elevation true fir stands, the likelihood of pine mortality would still be high.

Annosus Root Disease (*H. annosum)* would continue to exist in areas it is in currently and continue to spread, primarily through the roots. With Alternative 1, there would not be exposed stumps for potential long distance spread from airborne spores.

Alternative 2 (Proposed Action)

Stand Composition, Structure, and Density

In Alternative 2 there are approximately 10,670 acres proposed for treatment within the South Shore project area. The forest stands proposed for treatment consist primarily of the mixed conifer forest type occupying about 6,971 acres within an elevation range of 6,300-7,000 ft. and approximately 2,017 acres of the Jeffrey pine forest type occurring above 6,200 ft (Table 3-33).

Streamside vegetation and the aspen (*Populus tremuloides*)/meadow community type also occur in some of the proposed treatment areas. Aspen stands identified for treatment are instances where aspen appear to be in decline, and the aspen are generally overtopped by conifers, or conifer encroachment is occurring (Map 12).

Table 3-33. Project treatment area cover types

Cover Type	Acres
Forest	
Mixed Conifer	6,971
Jeffrey Pine	2,017
Red fir	466
Lodgepole Pine / Riparian	730
Aspen	293
Non-Forest	
Brush/Other	193
Project Treatment Area Total	10,670

Within all proposed treatment areas, healthy fire-resilient dominant and co-dominant overstory trees would be retained, resulting in an overstory consisting primarily of shade intolerant species; such as Jeffrey pine, and sugar pine where it currently exists. Some stands would have a mix of pine with red fir, white fir and/or incense cedar. Some trees in the mid-story and understory would be retained where they are healthy well-growing trees that are isolated from serving as ladder fuels. Some wildlife stands would have more of the smaller trees in the understory retained to meet required habitat conditions.

Prescribed hand pile and burning conducted in hand thinned stands post-thinning would remove excess remaining surface fuels resulting in reduction of surface fuels to the desired levels of 10 to15 tons per acre. Prescribed underburning of some mechanically thinned (whole tree yarded) units would also be conducted post thinning. Prescribed burning poses a risk of damaging or killing residual trees. This risk is mitigated by concentrating fuels away from live trees, and by burning under weather conditions that promote low flame lengths and low burning intensities. Generally, mortality of up to 15% of the residual trees in the stand may occur as a result of prescribed burning. Mortality from prescribed burning would primarily occur in smaller understory trees that have thinner bark and crowns closer to ground level. This prescribed burning would not appreciably alter the stand structure achieved by thinning.

Hand Thinning

Hand thinning would treat 4,942 forested acres where mechanical equipment is not feasible. Hand treatment applies to stands that are located in areas where slopes are greater than 30%, areas of sensitive soils, and areas where road access is limited or unavailable. Stands to be treated are moderate to heavily dense and have large areas of continuous surface, ladder and canopy fuels.

Generally, the size of cut trees would be within 14 inches dbh or less; however, some stands would have trees up to 20 inches dbh cut. The larger diameter trees would be cut in stands where densities would otherwise remain too high to change the predicted fire type to a surface fire as described in the Fire and Fuels section of this chapter. Objectives for hand thinning treatments include both the desired predicted fire type as well as desired stand densities. Desired residual stand densities would include maximum SDIs of about 40%, and BAs averaging 80ft^2 to 120ft^2.

Hand thinning treatment would generally remove lodgepole pine, white fir, red fir and incense cedar in the understory. Hand thinning treatment includes approximately 2,018 acres of stands that would be thinned to 70 trees per acre, or about 25 feet of spacing between tree boles and approximately 1,137 acres of stands that would be thinned to 100 trees per acre, or about 21 feet of spacing between tree boles. The difference in residual trees per acre is to adjust for slope and other factors such as existing insects, disease, or dwarf mistletoe. Wider spacing of trees is more effective at reducing fire intensity and spread on steeper slopes, therefore the 70 trees per acre prescription would apply on steeper slopes. In order to reduce potential spread, the 70 trees per acre retention would also apply where a higher degree of insects, disease or dwarf mistletoe exits.

Hand thinning methods are often limited in meeting desired stand conditions or retaining them for desired periods of time. The size and number of trees felled are limited when treatment requires manual removal and piling of trees after thinning. This often results in fewer trees felled and removed than would fully meet desired stand densities. The average maximum SDI post treatment would be just over 50% (Table 3-34) in these areas.

Approximately 1,550 acres identified for treatment in Alternative 2 are located within wildlife protected activity centers (PACs), eagle habitat areas, or other special wildlife areas. The number of residual trees per acre was modified in each instance to maintain as much of the desired habitat conditions as possible, such as existing canopy cover in PACs. Remaining TPA would range from about 70 to 160 TPA. The result would often require stands to have a higher stand density than desired for fuel reduction or forest health. The average maximum SDI post treatment would be about 57% (Table 3-34).

Table 3-34. Current and post-treatment values

Treatment	Current Conditions		Post-Treatment	
	Ave % Max SDI	Ave. BA (ft^2)	Ave. % Max SDI	Ave. BA (ft^2)
Hand Thin-70*	68	200	50	154
Hand Thin- 100**	58	156	53	147
Hand Thin – WL***	95	218	57	177

* Stands thinned to 70 trees per acre
** Stands thinned to 100 trees per acre
*** Wildlife stands

Approximately 2,649 acres of the hand thinned units would not meet desired SDIs and BAs, including 1,116 acres of the wildlife stands. Approximately 3,723 acres of hand thinned units would be above the desired 60% maximum SDI level 10 years after treatment (Table 3-35).

Table 3-35. Treatment values after 10 and 20 Years

10 Years Post-treatment	Ave % Max SDI	Ave BA (ft^2)	20 Years Post-treatment	Ave % Max SDI	Ave BA (ft^2)
Hand Thin-70	58	179	Hand Thin-70	63	204
Hand Thin- 100	56	166	Hand Thin- 100	65	194
Hand Thin - WL	59	204	Hand Thin - WL	65	230

Stands treated with hand thinning and prescribed burning would help shift the forests towards past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads and fuel ladders, which would reduce risk of high intensity wildfires, as well as reduce densities and improve overall health of the stands. For the hand thinning stands, the treatment would last only about 5 years for 50% of the stands and 10 years for about 25% of the stands. The other 25% of the stands would last for 20 years.

Ongoing maintenance treatments will be needed in order to control the regeneration of shade tolerant species that would increase fuel loads and ladders within the stands over time and maintain the growth and vigor of the retained overstory trees.

Mechanical Thinning

Mechanical thinning treatments would treat 5,728 forested acres. Of those, 3,818 acres would use a whole-tree system and 1,910 acres would be cut-to-length. Stands that would be treated have moderate to heavy densities and have large areas of continuous surface, ladder and canopy fuels. Most stands have an average SDI ranging from 70% to over 100% of maximum. The overall average is at 93% SDI. The average range of current basal areas is approximately 150 to 400 square feet. Inter-tree competition is reducing stand growth and vigor at these densities. The desired stand densities would include maximum SDIs of about 40% and basal areas of 80 to 120 square feet after treatment.

Mechanical thinning would remove an average of about 50% of stand basal area stocking. Mechanical thinning would remove trees up to 30 inches dbh, with most trees being 20 inches dbh or less. In order to meet desired stand density conditions and fuel loading, approximately 48 of the stands totaling about 1,566 acres would include removal of trees between 20 and 30 inches dbh. Trees 30 inches dbh and greater would only be cut to facilitate operability (2004 SNFPA ROD) The current 30 inch diameter limit for thinning stands would limit meeting the desired stand conditions after treatment on only about 21 acres of non-wildlife stands.

There would be a wide range in average remaining trees per acre of between about 30 to 150 TPA, with the greatest variability within the wildlife stands. The average TPA over all stands would be approximately 65 TPA.

The overall average SDI for mechanical stands outside of wildlife habitat areas would be just under 40% maximum SDI (Table 3-36). After 20 years, most of those stands would still be in the desired average stand density range (Table 3-36). Only about 50 acres of mechanically thinned stands would be above the maximum SDI level of 60% after 20 years post treatment.

Table 3-36. Current and post-treatment value

Treatment	Current Conditions		Post-treatment	
	Ave % Max SDI	Ave. BA (ft^2)	Ave. % Max SDI	Ave. BA (ft^2)
Cut-to-Length	100	217	37	106
Whole Tree	89	192	39	120
Mechanical - WL	91	204	55	166

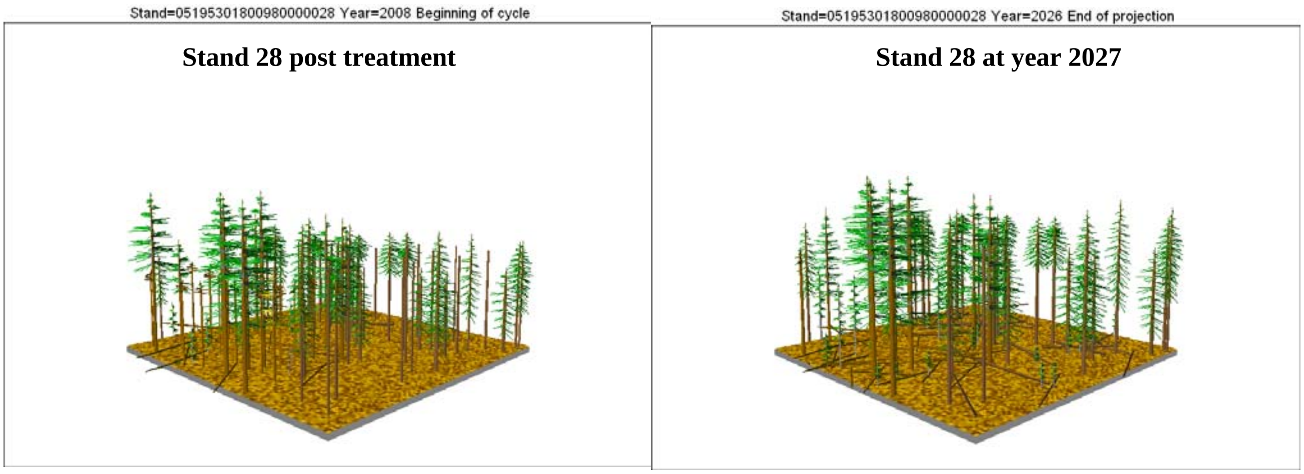
Approximately 2,696 acres of stands are located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas. The residual SDIs were modified in each instance to maintain as much of the desired habitat conditions as possible (such as existing canopy cover in PACs). The result often required stands to have higher stand density than desired. Approximately 1,682 acres of the wildlife stands would not meet desired SDIs and BAs after initial treatment. Resulting stand densities in wildlife areas would average about 55% max SDI (Table 3-36). Approximately 2,188 acres of wildlife stands would be above the maximum SDI level of 60% after 10 years post treatment. Resulting stand densities in wildlife areas would average about 70% max SDI (Table 3-37) within 20 years after treatment.

Table 3-37. Treatment values after 10 and 20 years

10 years Post-treatment	Ave % Max SDI	Ave BA (ft^2)	20 years Post-treatment	Ave % Max SDI	Ave BA (ft^2)
Cut-to-Length	45	129	Cut-to-Length	51	150
Whole Tree	45	138	Whole Tree	50	159
Mechanical - WL	65	186	Mechanical - WL	71	210

Ongoing maintenance treatments will be needed in order to control the regeneration of shade tolerant species that would increase fuel loads and ladders within the stands over time and maintain the growth and vigor of the retained overstory trees.

The same representative stand that was projected for the No Action alternative existing conditions shown in Figure 3-6 above was modeled in the forest vegetation simulator model (FVS) to display and compare for projected stand conditions with a mechanical thinning treatment under Alternative 2. The stand is a mixed conifer stand with 518 TPA, an SDI above 100% of maximum, and a basal area of 378 square feet per acre. The stand is lightly infected with mistletoe with approximately 6 trees per acre infected and a DMI of 1.6. The projected results of proposed thinning on this stand provide an example of conditions and results for stands at similar densities and undesirable stand conditions. This stand's current condition is shown in Figure 3-6 above, and is shown post treatment and after 20 years in Figure 3-7 below.



Source: USDA Forest Service, “Forest Vegetation Simulator”

Figure 3-7. Stand conditions post-treatment and after 20 years

After mechanical thinning, this stand had 53 TPA with diameters ranging primarily between 12 inches and 20 inches dbh. The stand averaged 122 square feet of basal area per acre and was at 40% of maximum SDI. Stand development at twenty years was also modeled in FVS and had an average of 160 feet of basal area per acre and was at 53% of maximum SDI. The number of trees per acre does not include the projected natural regeneration that may occur.

Dwarf mistletoe remained in the stand overstory after thinning, indicating that the larger diameter trees (greater than 20 inch dbh) were the infected trees. Compared to the No Action Alternative, the number of trees infected over time was reduced under Alternative 2. One additional tree is projected to become infected in the 20-year timeframe. Because there would be fewer total trees, and the remaining large trees already infected are included in the averaged overall infection (DMR), the level of infection appears to increase. A summary of stand conditions post thinning, in 10 years, and in 20 years is shown below (Table 3-38).

Table 3-38. Stand 28 Pre- and Post Thinning Summary Conditions Over 20 Years

Year	TPA	BA	SDI	DMI	DM-TPA
2007 (pre)	518	378	654	1.6	6
2008 (post)	53	122	168	1.6	6
2017	52	141	200	2.1	6
2027	52	160	221	3.0	7

With Alternative 2, the mechanically thinned stands would have prescriptions allowing for removal of larger trees than the hand thinned stands, resulting in desired stand conditions that would last for a longer time. For mechanically thinned stands outside of wildlife areas, the treatments should last for at least 20 years. Stands treated with mechanical thinning would help shift the forests towards desired past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads and fuel ladders for reducing risk of high intensity wildfires, as well as reduce densities to improve overall health of the stands.

Aspen Treatments

Approximately 293 acres of aspen stands would be thinned in order to reduce conifer encroachment (Map 12). Thinning of aspen stands would include the removal of all or most conifers creating openings and leaving canopy covers of only about 10% to 20%. The thinning treatments would enhance growth of aspen and other meadow vegetation. For the remaining aspen trees, there would be less competition for light, and more available soil moisture, allowing for an increase in aspen growth rates (Shepperd et al. 2006).

After approximately three years and follow-up treatment such as prescribed fire, regeneration through root suckering is expected and would increase the aspen population and reduce likelihood of future encroachment. Over the following 15 years the aspen saplings would become established and after about 20 years the stands would be close to achieving desired conditions.

Thinning Operations and Roads

Thinning operations would have effects on forest stand structure. Whole tree yarding would create small clearings of about ½ acre to an acre in size for log landings and processing. Some openings already exist; however, most have regrowth since they were last used and would require clearing of small trees. Cut-to-length logging would also require small clearings, or landings, generally less than 1/2 acre, to store logs prior to trucking. Landing size depends on the topography, the number of trees to be brought in, and the harvest equipment. The total number of acres cleared as landings for mechanical operations would be about 150-200 acres. Clearings (mainly those used for whole tree yarding) would receive erosion control and soil protection measures (see Chapter 2) as soon as possible following completion of operations. Based on field review of landings from past projects within the South Shore project area, it is expected in both the seeded and non-seeded areas to have some type of natural vegetation established over time, mainly shrub species, and some conifers.

Road reconstruction and maintenance would clear trees from the road way and ditches. Trees to be removed are mostly saplings and seedlings which have become established since construction or the last road maintenance activity. The construction of 4.8 miles of new temporary road would clear approximately 6 acres of trees. Based on field review of old roads within the project area, the same results as for the landings are expected over time for temporary roads that would be decommissioned at completion of the project.

Treatment prescriptions preclude the harvest of trees 30 inches in diameter and larger; except in cases where these trees need to be cut to facilitate operability (2004 SNFPA ROD). These cases could include: clearing for landings, temporary road construction, and hazard tree removal. Clearing for harvest and temporary road construction operations is expected to impact less than 15% percent of the treated area.

Forest Health

Thinned stands would increase forest health in the treatment areas by removing damaged and diseased trees and favoring retention of trees that are the most vigorous, with well developed crowns indicating better overall growth. Thinning would reduce competition and allow remaining trees to improve their overall growth and vigor and better withstand disease and insect attacks.

Dwarf Mistletoe

Dwarf mistletoe in the project area infects true fir as well as Jeffrey pine. Selectively removing trees infected with dwarf mistletoe (*Arceuthobium spp*.) from stands that are heavily infected and widespread will rarely if ever completely remove it from a stand. Multi-storied stands that have or develop mistletoe in the overstory will spread the disease to the young trees growing below. Maintaining a species mix so that non-host trees provide some physical barrier between susceptible trees, as well as selectively removing heavily infected trees, particularly in the overstory, helps prevent the development of undesirable infection levels in a stand.

The proposed action would reduce the spread of dwarf mistletoe to some degree; however, existing management direction will limit the amount of overall mistletoe reduction because removal of larger trees that may be heavily infected with dwarf mistletoe is prohibited. In stands where it is important to maintain stocking levels and canopy cover for wildlife habitat, infected trees would remain in the stands and would continue to serve as a source for the infection of adjacent and understory trees.

Bark Beetle

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

Annosus Root Disease

Both action alternatives propose to apply an EPA registered borate compound (Sporax) to all cut stumps of true fir and pine trees greater than 14 inches in diameter to protect against the spread of annosus root disease.

H. annosum is present in the South Shore project area, and there is the potential for new infection in treatment areas from aerial dispersion of spores. Infection by *H. annosum* may become more wide spread if stumps are not treated. This would make the long-term control of annosus root disease more difficult and may impact previously unaffected stands, as well as adjacent landowners. The disease could create infection centers where trees of susceptible species would begin to display effects ranging from reduced individual tree vigor, root and bole decay, wind-throw, root mortality, and tree mortality. The infection centers would create localized pockets of dying, dead and down trees which would contribute to higher surface fuel accumulation in the future as well as increased public safety hazards in and adjacent to recreation sites, communities, and private homes. There are no proven methods for eradicating this disease from a site once it becomes infected.

The application of a borate compound would occur on approximately 5,728 acres of thinning treatments that include removal of trees greater than 14” dbh. Sporax is a borate compound registered for use to control *annosum* root disease. When applied to fresh cut stump surfaces, the borate compound penetrates into the upper stump surface and provides a protective barrier in which *H. annosum* spores are unable to survive. When applied properly, the use of Sporax has been shown to be up to 90% effective at preventing new infections of annosus root disease on stump surfaces (Schmitt et al 2000). The recommended application level is one pound of Sporax to 50 square feet of stump surface (Wilbur-Ellis, undated). The basal area requiring Sporax treatment when using a 14-inch lower-dbh limit would range from approximately 80 to 335 square feet per acre, with an average of approximately 97 square feet per acre. Basal area requiring treatment is calculated based on basal area at dbh; however the difference between basal area at dbh versus stump basal area at 1 foot has a negligible effect on estimating average application rates. Given the recommended application level, the amount of Sporax application per acre would range from approximately 1.6 to 6.7 pounds, with an average of approximately 1.9 pounds per acre.

The use of Sporax has been analyzed for environmental risk and human health and safety within the South Shore project. Control measures to protect aquatic features and TES plants are described in Chapter 2. No Sporax would be applied within 25 feet of standing or running water. Sporax application rates would be low (generally less than 1 pound per acre) within stream environment zones because of equipment exclusion zones and high levels of tree retention in SEZs. An application rate of 10 pounds per acre (over 10 times the projected application rate) would result in a concentration level of 100 ppb (parts per billion) of sporax in water. This equates to a Q-value of 0.00004, well out of the EPA acute toxicity level of >0.1. Both location and application rate of Sporax would pose little potential for water contamination. Sporax would not be applied during rainfall events to avoid washing off target stump surfaces. A project specific spill plan is included in project records. Research indicates that if a significant spill occurred, it is unlikely that measured amounts in water would be above background, natural levels of boron (Dost et al. 1996). The potential for Sporax leaching is low as it is adsorbed to mineral particles in the soil (Dost et al. 1996).

High levels of Sporax are considered toxic to soil microorganisms and plants. Application rates of 9 to 15 lbs per 100 square feet (ground surface area) applied directly to vegetation will eradicate plants (Dost et al. 1996). These levels are much higher than application rates proposed for stump treatment. Research data has not indicated elevated levels of boron in foliage, litter or soil adjacent to treated stumps (Dost et al. 1996). Research suggests that accumulation of boron resulting from cut stump applications sufficient to harm either nearby plant life, or animals that depend on those plants for subsistence is unlikely (Dost et al. 1996).

Extreme cases of chronic over-exposure have produced symptoms of chronic poisoning, respiratory irritation, and chronic eczema in humans, but there is no evidence that Sporax use in a forested setting has resulted in chronic health issues (Dost et al. 1996). Applications of Sporax within the South Shore project would follow all applicable Federal and California rules and regulations, including requirements for worker protection, storage, and environmental protection. Dost et al. (1996) concludes “the evidence indicates that workers who apply Sporax or DOT to cut stumps are not at risk of adverse effects due to boron exposure. Existing data also indicates that adverse effects of forest uses of Sporax or DOT on wildlife or livestock are improbable.” Since the use of Sporax has not been shown to cause toxicity to soil, water, plants or humans in a forested setting and the proposed treatment would be a one-time, low dosage site specific application, no measurable cumulative effects are anticipated (USDA FS 1995; Dost et al. 1996).

Other methods for controlling annosus root disease have been suggested. Many of these alternative methods have been developed for forests in the southeastern United States. Several treatment strategies (prescribed burning, manipulation of season of cutting to avoid dispersion of spores, and treatment with a competitive nontoxic fungus [*Phlebiopsis gigantea*]) have been recommended in the southeastern region by Mississippi State University Extension and others (Ammon and Patel 2000; Annesi et al. 2005). Intensive prescribed burning before and after treatment, as suggested by Ammon and Patel, may not be a viable option due to prohibitive cost and inherent wildfire risk associated with pre-treatment burning in the South Shore project area. Studies of prescribed burning have shown a reduction of annosus root disease but have not shown burning to control or prevent the infection of *annosus*. In a study by Froelich et al. (1978), many of the prescribe burn plots showed substantial infection levels of *annosus* after burning. Cutting when *H. annosum* spores are at their lowest levels has been suggested, however, there are no data or studies to support the effectiveness of such a treatment. The competitive fungus, *Phlebiopsis gigantean*, is not available or registered for use in California and may not be a viable treatment due to the dry summer and fall seasons in the South Shore project area. The treatment strategies discussed above were developed for forests in the southeastern United States, and there is no literature that suggests that such methods would be effective in California. The amount of Sporax applied within the 5,728 acres of treatment could be reduced by limiting Sporax use to areas that have been identified as having annosus root disease and the immediate proximity. Such target areas may be identified during field preparation activities (such as layout, marking, and cruising) prior to implementing the South Shore project. However, limiting Sporax application to known annosus root disease infection centers would not protect against infection from airborne spores, which can travel for long distances. There is also a risk that an area with annosus root disease would fail to be identified during field project preparation.

Alternative 3

The objective for development of Alternative 3 is to respond to public and agency comments to reduce environmental impacts while still meeting the needs and achieving these purposes identified for the project. Comparisons between Alternative 2 and Alternative 3 are included in the discussion of Alternative 3 to clarify the differences between the two action alternatives before the discussion of effects specific to Alternative 3.

Stand Composition, Structure, and Density

Alternative 3 would apply the same treatments as described under the proposed action except the acres of stands thinned with mechanical equipment would be reduced and acres of hand thinning would increase (Table 3-39). There is also a shift in mechanical treatment acres from whole tree to cut-to-length methods. The changes in the acreage for application of those treatments was based on interdisciplinary team field review, data review, and fire behavior modeling of areas proposed for treatment in the project.

Table 3-39. Comparison of total acres of treatments for both alternatives

Treatment Type	Alternative 2 Acres	Alternative 3 Acres	Difference Acres
Hand Thinning	4,942	5,987	1,045
Cut-To-Length	1,910	2,010	100
Whole Tree	3,818	2,141	-1,677
Total	10,670	10,138	-532

The amount of stands treated within wildlife areas would also be reduced (Table 3-40). Changes to treatments are aimed at reducing impacts to sensitive species and their habitats as discussed in the wildlife section of this analysis.

Table 3-40. Comparison of total acres of treatments within wildlife areas for each alternative

Wildlife Stands Treatment	Alternative 2 Acres	Alternative 3 Acres	Change Acreage
Hand Thin WL	1,550	1,962	412
Mechanical WL	2,696	1,728	-1,168
Total Wildlife	4,246	3,690	-556

Alternative 3 would have fewer total acres of thinning treatments than Alternative 2. The amount of pile burning would increase because Alternative 3 would also have less mechanical thinning and more hand thinning. The number of acres chipped or masticated would increase due to changes in mechanical thinning methods, with more cut-to-length instead of whole tree yarding. Table 3-41 compares activity acres for the action alternatives.

Table 3-41. Treatment comparison of action alternatives

Activity	Alternative 2 (acres)	Alternative 3 (acres)	Acres Difference
Hand Thin	4,942	5,987	1,045
Pile Burn	4,372	5,217	845
Under Burn	850	774	-4
Mechanical Thinning	5,728	4,151	-1,577
Mechanical Chipping / Mastication	2,480	2,617	137
Hand Lop and Scatter	198	170	-28
Helicopter Yarding	0	0	0

Hand Thinning

For Alternative 3, hand thinning would be applied on 5,987 forested acres. Approximately 1,962 acres of stands are located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas. The number of residual trees per acre were modified in each instance to maintain as much of the desired habitat conditions (such as existing canopy cover in PACs) as possible, ranging from about 70 TPA to 160 TPA. The result often required stands to have a higher stand density than desired (Table 3-42).

Table 3-42. Current and post-treatment values

Current Condition	Ave % Max SDI	Ave BA (ft^2)	Post-Treatment	Ave % Max SDI	Ave BA (ft^2)
Hand Thin-70	70	198	Hand Thin-70	51	152
Hand Thin- 100	65	164	Hand Thin- 100	48	145
Hand Thin - WL	77	202	Hand Thin - WL	53	161

The increase in overall hand thinning treatments in Alternative 3 increases the amount of acres that would not meet the desired condition of the stand for reducing stand densities although improvement toward desired conditions would be achieved. Approximately 3,610 acres of hand thinned units would not meet desired SDIs and BAs post treatment, including approximately 1,226 acres of wildlife stands. Hand thinning stands are often limited in meeting desired stand conditions or retaining them for long periods of time when compared to mechanical thinning methods. Approximately 3,953 acres of hand thinned stands would have maximum SDIs above 60% after 10 years. See below for expected stand conditions over time (Table 3-43).

Table 3-43. Treatment values after 10 and 20 years

10 years Post-treatment	Ave % Max SDI	Ave BA (ft^2)	20 years Post-treatment	Ave % Max SDI	Ave BA (ft^2)
Hand Thin-70	57	177	Hand Thin-70	64	201
Hand Thin- 100	52	163	Hand Thin- 100	58	185
Hand Thin - WL	60	187	Hand Thin - WL	66	211

Stands treated with hand thinning and prescribed burning would help shift the forests towards past conditions when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. The treatments would reduce fuel loads and fuel ladders for reducing risk of high intensity wildfires, as well as reduce densities to improve overall health of the stands. For the hand thinning stands, the treatment would last only about 5 years for 40% of the stands and 10 years for about 34% of the stands. The other 26% would last for about 20 years. Ongoing maintenance treatments will be needed in order to maintain continuous growth and vigor of the remaining trees and reduce regeneration of shade tolerant species that would increase fuel loads and ladders within the stands over time.

Mechanical Thinning

Mechanical thinning would treat 4,151 forested acres for Alternative 3. Of those, 2,141 acres are whole-tree logging system and 2,010 acres of cut-to-length. Most of these stands have an average SDI ranging from 70% to over 100% of maximum, with an overall average of 96%. The average range of current basal areas is approximately 150-400 square feet. At these densities, inter-tree competition is reducing stand growth and vigor. Mechanical thinning would remove an average of about 50% of stand basal area stocking. Residual average stand basal area would generally range between 80 and 200 square feet.

Mechanical thinning would remove trees up to 30 inches dbh, with most trees being 20 inches dbh or less. Approximately 39 of the stands totaling about 1,064 acres would include removal of trees between 20 and 30 inches dbh in order to meet desired stand density conditions and fuel loading,. Trees 30 inches dbh and greater would only be cut to facilitate operability (USDA FS 2004 SNFPA ROD).

The current 30 inch diameter limit for thinning stands would limit meeting the desired stand conditions of 40% maximum SDI after treatment on only about 11 acres of non-wildlife stands. The overall average for mechanical stands outside of wildlife habitat areas would be just under 40% max SDI (Table 3-44). After 20 years, most of those stands would still be in the desired average stand density range (Table 3-29). Only about 91 acres of mechanically thinned stands would be above the maximum SDI level of 60% 20 years after treatment.

Table 3-44. Current and post treatment values

Current	Ave % Max SDI	Ave BA (ft^2)	Post-Treatment	Ave % Max SDI	Ave BA (ft^2)
Cut-to-Length	106	209	Cut-to-Length	36	103
Whole Tree	81	180	Whole Tree	37	117
Mechanical - WL	96	214	Mechanical - WL	58	169

In Alternative 3, there are approximately 1,728 acres of stands located within wildlife protected activity centers (PACs), eagle habitat areas or other special wildlife areas that would be mechanically thinned. This is a reduction of 1,168 acres from Alternative 2. Approximately 1,486 acres would not meet desired SDIs and BAs after initial treatment under Alternative 3. Resulting stand densities in wildlife areas would average just under 60% maximum SDI (Table 3-44).

At 20 years after treatment, approximately 1,454 acres of wildlife stands would be above the maximum SDI level of 60%. Resulting stand densities would average about 70% maximum SDI (Table 3-45).

Table 3-45. Treatment values after 10 and 20 years

10 Years Post-treatment	Ave % Max SDI	Ave BA (ft2)	20 Years Post-treatment	Ave % Max SDI	Ave BA (ft2)
Cut-to-Length	45	126	Cut-to-Length	52	151
Whole Tree	45	122	Whole Tree	50	159
Mechanical - WL	66	196	Mechanical - WL	72	218

Aspen Treatments

Aspen stand acres would change from 293 acres treated with Alternative 2, to 251 acres treated with Alternative 3. The activities and effects for Alternative 3 would be the same as Alternative 2 for the acres treated. Thinning of aspen stands would include the removal of all or most conifers which would enhance aspen and other meadow vegetation. With less competition for light, and more available soil moisture, the size and growth rates of aspen trees should increase over time (Shepperd et al. 2006).

Thinning of aspen stands would include the removal of all or most conifers creating large openings leaving canopy covers of about 10% to 20% under both of the action alternatives. Within approximately three years and follow-up treatment such as prescribed fire, regeneration through root suckering is expected and would increase the areas population and reduce chance of future encroachment. Over the following 15 years the aspen saplings would become established and after about 20 years the stands would be close to achieving desired conditions.

Harvest Operations and Roads

The Changes from mechanical thinning to hand thinning result in a reduction in temporary roads and landings needed for logging operations in Alternative 3(Table 3-46).

Table 3-46. Summary of roads and landings needed between Alternatives 2 and 3

	Alternative 2	Alternative 3	Decrease
New temporary roads	25,336 feet	20,222 feet	- 5,114 feet
Existing temp roads	54,145 feet	45,158 feet	-8,987 feet
Number of Landings	222	178	-50 landings

The total number of acres cleared as landings for mechanical harvest operations would be reduced from 150-200 acres in Alternative 2, to about 100-150 acres in Alternative 3. The construction of new temporary roads would be reduced by a mile to total approximately 3.8 miles. The total number of acres cleared for new temporary road construction would also be reduced by about one acre to total approximately 5 acres. Temporary roads would be decommissioned at project completion the same as in Alternative 2.

Treatment prescriptions preclude the harvest of trees 30 inches in diameter and larger; however, in some cases, these trees may need to be cut to facilitate operability (2004 SNFPA ROD). These cases could include: clearing for landings, temporary road construction, and hazard tree removal. As in Alternative 2, clearing for landings and temporary road construction operations is expected to impact less than 15 percent of the treated areas.

Forest Health

Thinned stands would increase forest health in the treatment areas by removing damaged and diseased trees and favoring retention of trees that are the most vigorous, with well developed crowns indicating better overall growth. Thinning would reduce competition and allow remaining trees to improve their overall growth and vigor and better withstand disease and insect attacks.

Dwarf Mistletoe

Effects from implementation of Alternative 3 are similar to Alternative 2. Dwarf mistletoe in the project area infects true fir as well as Jeffrey pine. Selectively removing trees infected with dwarf mistletoe (*Arceuthobium spp*.) from stands that are heavily infected and widespread will rarely if ever completely remove it from a stand. Multi-storied stands that have or develop mistletoe in the overstory will spread the disease to the young trees growing below. Maintaining a species mix so that non-host trees provide some physical barrier between susceptible trees, as well as selectively removing heavily infected trees, particularly in the overstory, helps prevent the development of undesirable infection levels in a stand.

Alternative 3 would reduce the spread of dwarf mistletoe to a lesser degree than Alternative 2 because fewer acres would be thinned and existing management direction limits the removal of larger trees that may be heavily infected with dwarf mistletoe. With Alternative 3 more stands would be hand thinned instead of mechanically thinned which would reduce the amount of infected tree removal since the thinning treatment has a lower diameter for tree falling. Some stands or portions of stands, primarily within wildlife areas, were dropped from the proposed treatment in Alternative 3. In stands where it is important to maintain stocking levels and canopy cover for wildlife habitat, infected trees would remain in the stands and would continue to serve as a source for the infection of adjacent and understory trees.

Bark Beetle

As in Alternative 2, thinning would decrease the risk of stand mortality caused by bark beetles for Alternative 3. Thinning would remove diseased and injured trees, which are most susceptible to bark beetle caused mortality (Demars and Roettgering 1982, Ferrel 1986, Kegley et al. 1997, Smith 1971), and also reduce tree competition, which can improve resistance to beetle caused mortality.

Annosus Root Disease

As discussed in Alternative 2, this alternative also proposes to apply an EPA registered borate compound (Sporax) to all cut stumps of true fir and pine trees equal to or greater than 12 inches to protect against the spread of annosus root disease. The effects of applying a borate compound to 4,151 acres of thinning under this alternative would be the same as those discussed under Alternative 2.

With Alternative 3, stands were dropped from the project in some areas such as wildlife areas, and other stands were changed from a proposed mechanical thinning treatment to hand thinning. The decrease in mechanical treatments would also reduce the acres of which the sporax compound would be applied. This treatment applies mainly to the mechanically thinned stands; however, there are hand thinned stands with prescriptions for falling of larger trees in which application of sporax would occur. Thrifty well growing trees are thought to have some resistance by outgrowing the rate of infection. The proposed treatments will maintain or improve tree vigor by reducing stand densities, however, thinning is not expected to remove all annosus infection, nor will it address infections outside of treatment stands.

Alternative Comparison Summary

Although forests are dynamic systems, and are constantly changing, these changes are somewhat less predictable than expected effects from the action alternatives. For comparison of the alternatives, the No Action alternative is shown as remaining in the existing conditions. Alternative 2 would treat more acres within the project area than Alternative 3 and more acres would be mechanically thinned rather than hand thinned. Both action alternatives would have similar residual average densities after both hand and mechanical thinning, including the wildlife stands. The increase in hand thinning with Alternative 3 would result in an increase in the acres that would exceed desired stand densities after treatment. This increase also occurs within the wildlife stands. Compared to Alternative 1 (no action) both action alternatives greatly reduce the overall stand densities and number of acres exceeding the desired 40% maximum SDI level (Table 3-47).

Table 3-47. Summary of alternatives

Alternative		Hand Thin	Mechanical Thin	Wildlife PAC
1 No Action	Acres	3,392	3,032	4,246
	Ave % Max SDI	60	97	85
	Ave BA	165	209	203
	Acres >40% MSDI	2,090	2,845	3,601
2 Proposed Action	Acres	3,392	3,032	4,246
	Ave % Max SDI	52	38	56
	Ave BA	150	113	172
	Acres >40% MSDI	1,533	21	2,798
3 Alternative 3	Acres	4,025	2,423	3,690
	Ave % Max SDI	50	37	56
	Ave BA	150	110	165
	Acres > 40% MSDI	2,384	11	1,226

The greater number of acres treated and greater reduction in stand densities in Alternative 2 would result a greater shift toward desired forest conditions throughout the project area. Desired forest conditions under either of the action alternatives would be similar to when they were dominated by widely spaced, large-diameter trees, such as Jeffrey pine and sugar pine. Treated areas would be more open and dominated by larger trees with relatively few scattered understory trees and regeneration. For both action alternatives, trees would be healthier and better able to withstand background levels of insect and disease outbreaks.

Cumulative Impacts

Activities and management since 1986 within the project area are considered in this analysis because the effects of the past silvicultural treatments are still occurring (i.e. Improved health and vigor of thinned stands, reduction of fuel surface fuel loads and ladder fuels, and the establishment or maintaining of pine stands). Management activities and events prior to this are considered in this analysis in so far as they have shaped current stand structure conditions.

The existing stand conditions are the result of past management and treatments that include logging, fuelwood harvest, hand thinning for fuels reduction, and fire suppression. Stand structure has likely changed following Comstock-era logging between 1880 and 1920. Prior to European settlement of the west and Comstock-era logging, large trees characterized Sierran forests, relatively open understories with only occasional ladder fuels (Verner and McKelvey, 1994). Open stands dominated by larger trees with relatively few scattered understory trees and regeneration are conditions that supported low to moderate intensity ground fires.

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

Past Activities

Descriptions of current stand composition, structure and density as described in the "Existing Conditions" section of this document, account for and include changes as a result of past actions. All known past activities from 1986 through 2007 are shown below (Table 3-48).

Table 3-48. Activities in the project area from 1986 to 2007

Activity	Acres
Hand Thin	4,827
Pile Burn	10,312
Under Burn	5,505
Mechanical Thinning	8,193
Mechanical Chipping or Mastication	9,121
Hand Lop and Scatter	1,400
Helicopter Yarding	849

Past hand and mechanical thinning primarily entailed thinning from below similar to the proposed action for the South Shore project. Thinning from below removes predominantly smaller trees and retains healthy larger overstory trees. Thinning and prescribed burning occurred in order to reduce the risk of high intensity wildfires by reducing fuel loads and fuel ladders, as well as reducing stand densities to improve overall health of the stands.

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

Stands that have had salvage harvest of fire killed or windthrown trees, or individual hazard tree removal can contain a wide range of residual stand structure. The salvage treatments are not shown as a separate activity in Table 3-48, instead treatment acres were included in the mechanical or hand thin category depending on how the trees were felled and/or removed.

The area considered for silviculture cumulative effects is the project area. This area was chosen because stand growth and development is primarily dependent on site conditions such as soils, elevation and precipitation. Stand and site conditions elsewhere (outside of the treated stands) generally have little effect on treated stands, with the exception of effects on forests insect populations.

Culmination of Mean Annual Increment (CMAI)

Stands proposed for thinning treatments were not evaluated for culmination of growth. These treatments are not subject to the CMAI finding. Thinning treatments are exceptions permitted for sound silvicultural practices to meet multiple use objectives (36 CFR 219.16(2)(iii)).

Alternative 1 (No Action)

Stand Composition, Structure and Density

Under the No Action alternative, stand composition would continue to have a decrease of pines and an increase in white fir, stand density would continue to increase, and the proportion of small trees in the stands would increase. The cumulative effect would be to continue the trends that began with logging in the Comstock era and subsequent fire suppression.

Forest Health

Mortality from competition for water, soil nutrients, and light would continue to increase. Individual tree health and vigor would decrease, and the stands would become more susceptible to disease, insects, and wildfire.

Without treatment, dwarf mistletoe would continue to spread within the currently infected stands and potentially outside these stands to adjacent forested areas in most cases. The level of infection would also continue to increase causing a cumulative increase in tree mortality.

Alternative 2 (Proposed Action)

Stand Composition, Structure and Density

Comparison of Alternative 2 treatment acres with the cumulative total acres provides an indication of the contribution to total thinning activities from Alternative 2 in the South Shore project analysis area. The acres of activities proposed for the South Shore project area under Alternative 2, and the cumulative total when adding past activities, is summarized in Table 3-49:

Table 3-49. Total acres of past and proposed activities in the project area

Activity	Alternative 2 (acres)	Analysis Area Total (acres)
Hand Thin	4,942	9,769
Pile Burn	4,372	14,684
Under Burn	850	6,355
Mechanical Thinning	5,728	13,921
Mechanical Chipping or Mastication	2,480	11,601
Hand Lop and Scatter	198	1598
Helicopter Yarding	0	849

Cumulative effects of Alternative 2 for the South Shore project would be the addition of acres to the areas already treated from past projects. Thinning and prescribed burning would continue to retain or promote a higher component of pine within mixed conifer and white fir stands. Lower stand densities in the thinned stands will also promote the health of pine, since pine does not grow at the higher stocking densities where white and red fir can persist. Thinning and prescribed burning under Alternative 2 would add to past activities and cumulatively reduce fuel loads and fuel ladders, and contribute to reducing the risk of high intensity wildfires, as well as reducing stand densities to improve overall health of the forest. The degree of initial stand density reduction and lasting effects would be relative to the existing stand conditions and whether the stand is treated by hand or mechanical thinning.

Road construction from past projects throughout the project area has decreased the forested area. Areas of formerly forested lands are now clearings for roads. All temporary road construction as part of the South Shore project would be decommissioned as described Chapter 2. While there would be a short term loss of forest vegetation, there would be no increase of permanent road clearings, and therefore no long-term cumulative loss of forest vegetation from implementation of Alternative 2.

Forest Health

Thinned stands would increase the overall forest health by removing damaged and diseased trees and favoring retention of trees with well developed crowns indicating better overall growth and better withstand disease and insect attacks. Healthy thinned stands would not act as a reservoir for disease and insects to spread to other areas of the forest, which would have a positive cumulative effect for adjacent stands.

The proposed action would reduce the potential spread of dwarf mistletoe to some degree; both by removal of infected trees and maintaining a species mix that includes non-host trees. However, because it is important to maintain stocking levels and canopy cover for wildlife habitat, infected trees would remain in the stands and would continue to serve as a source for the infection of adjacent and understory trees. Cumulatively, dwarf mistletoe infection levels and rate of spread would decrease in the short term under Alternative 2.

Increased resistance to bark beetle in thinned stands would cumulatively help to disrupt the distribution of bark beetles to other areas of the South Shore project analysis area.

Annosus root disease is present in stands throughout the project area and is expected to remain near current levels of infection. While thinning has the potential to increase the disease through freshly cut stumps, the Proposed Action includes treatments to stumps to minimize annosus infection. This treatment applies mainly to mechanically thinned stands, however, there are a few hand thinned stands with prescriptions for falling larger trees that would include Sporax application. Thrifty well growing trees are thought to have some resistance by outgrowing the rate of infection. While the Alternative 2 treatments will maintain or improve tree vigor by reducing stand densities, thinning is not expected to remove all annosus infection, nor will it address infections outside of treatment stands. The cumulative effect of the proposed thinning treatments would favor the retention of pine over red and white fir which would help reduce the spread of root disease by reducing root-to-root contact between host tree species (true fir) as well as reducing host populations.

Alternative 3

Stand Composition, Structure and Density

Cumulative effects of Alternative 3 would be the addition of acres to the already treated areas from past projects. Thinning and prescribed burning would continue to retain or promote a higher component of pine within mixed conifer and white fir stands, similar to Alternative 2. Lower stand densities in the thinned stands would also promote the health of pine, since pine does not grow at the higher stocking densities where white and red fir can persist. Thinning and prescribed burning under Alternative 3 would add to past activities and cumulatively reduce fuel loads and fuel ladders, and contribute to reducing the risk of high intensity wildfires, as well as reducing stand densities to improve overall health of the forest. The degree of initial stand density reduction and lasting effects would be relative to the existing stand conditions and whether the stand is treated by hand or mechanical thinning. Alternative 3 allows a lower number of acres to be treated and more of the treatments would be hand thinning. The result would mean a lesser degree of initial stand density reduction and lasting effects for Alternative 3. The current and lasting conditions of the areas previously treated would also be based on whether the stand was treated with a hand thinning or mechanical thinning.

Comparison of Alternative 3 treatment acres with the cumulative total acres that includes past activities provides an indication of the contribution to total thinning activities from Alternative 3 in the South Shore project analysis area. The acres of activities proposed for the South Shore project area under Alternative 3, and the cumulative total when adding past activities, is summarized in Table 3-50

Table 3-50. Total acres of past and proposed activities in the project area

Activity	Alternative 3 (acres)	Project Area Total (acres)
Hand Thin	5,987	10,814
Pile Burn	5,217	15,529
Under Burn	774	6,279
Mechanical Thinning	4,151	12,344
Mechanical Chipping or Mastication	2,617	11,738
Hand Lop and Scatter	170	1,570
Helicopter Yarding	0	849

Road construction from past projects throughout the project area has decreased the forested area. Areas of formerly forested lands are now clearings for roads. All temporary road construction in Alternative 3 would be decommissioned as described Chapter 2. Because there is less temporary road construction in Alternative 3, there would be less short term loss of forest vegetation. However, as in Alternative 2, there would be no increase of permanent road clearings, and therefore no long-term cumulative loss of forest vegetation from implementation of Alternative 3.

Forest Health

As in Alternative 2, there would be a positive cumulative effect for both the treated and adjacent stands. Thinned stands would increase the overall forest health by removing damaged and diseased trees, reducing competition, and favoring retention of trees with better overall health. Healthy thinned stands would not act as a reservoir for disease and insects to spread to other areas of the forest.

Alternative 3 would reduce the overall spread of dwarf mistletoe to a lesser degree than Alternative 2. With Alternative 3 fewer infected trees would be removed since hand thinning has a lower diameter for tree falling and more stands were dropped from the proposed treatment in Alternative 3. Less treated areas would result in less dwarf mistletoe reduction within the project area and a lower cumulative benefit to the adjacent forest.

Alternative 3 would decrease the risk of stand mortality caused by bark beetles to a lesser degree than Alternative 2. Some stands or portions of stands, primarily within wildlife areas, were dropped from the proposed treatment in Alternative 3. Less treated areas would result in less of a decrease of risk of tree mortality caused by bark beetles within the project area.

Annosus Root Disease

Alternative 3 treatments will maintain or improve tree vigor by reducing stand densities, however, thinning is not expected to remove all annosus infection. The cumulative effect of thinning treatments would favor the retention of pine over red and white fir which would help reduce the spread of root disease by reducing root-to-root contact between host tree species (true fir) as well as reducing host populations.

C. Soil Resources

Scope of the Analysis, Indicators, and Issues

Scope

In addition to supporting native vegetation and wildlife, soils play a critical role in supporting watershed and ecosystem health through their functions of accepting, storing, and releasing water. The soils analysis for this project is limited to the soils in the analysis area. The activity area, as defined and discussed below, will be used as the geographic basis for analysis for the action alternatives. For the No Action alternative, the entire analysis area will be used to analyze the impacts of a potential wildfire.

The temporal scope for assessment of soil resource environmental effects includes short term (1-10 years following vegetation treatment) and long term (10-20+ years following vegetation treatment) for this analysis. This timeframe would capture both the immediate effects of the South Shore project activities and extend to follow the expected impacts to the point where they are no longer discernable from other activities.

The maintenance of productivity and the need to protect and improve the quality of the soil resource, and avoid permanent impairment of productive capability of Forest Service lands is governed by the Multiple Use and Sustained Yield Act of 1960, the National Environmental Policy Act of 1969, the Forest and Rangeland Renewable Resources Planning Act of 1974, the National Forest Management Act of 1976, and the California Environmental Quality Act (CEQA).

The LTBMU Land and Resource Management Plan (USDA Forest Service 1988) provides guidance specific to the Lake Tahoe Basin. Standards for maintaining soil productivity are found on pages IV- 39. Soil function in riparian conservation areas (RCAs) is addressed by standards 103, 111, and 122 in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004).

The policies that guide vegetation management practices in order to sustain soil quality The policies that guide vegetation management practices in order to sustain soil quality are found in the national and regional Forest Service Manuals and Handbooks. Soil quality standards and indicators are applied to “activity areas.” (USDA FS 1995). For this analysis, activity areas are defined as the individual treatment units and include vegetation treatment units, associated landings, and burn areas within a prescribed burn. System roads and trails and other areas not dedicated to growing vegetation are not included as part of the South Shore project activity areas. The activity area is considered an appropriate geographic unit for assessing environmental effects to soils because soil productivity is a site-specific attribute of the land; soil productivity of one area is not dependent on the productivity of an adjacent area. Thus, the activity area is used in this analysis as the geographic unit for assessing direct, indirect and cumulative soil environmental effects for the action alternatives.

Soil quality standards are intended to apply on an area basis (USDA FS 1995). This means that detrimental soils conditions, as defined by the standards, should not exceed a given percentage of the activity area. For most of the Forest Service regions, this percentage is 15%. Region 5 standards apply to all land dedicated to growing vegetation; the decision on what percentage of the activity area should meet the standards was considered a land allocation decision that should be made by the individual Forests. For monitoring done to evaluate this project, a threshold of 15% will be used.

Indicators

The Region 5 soil quality analysis standards are not a set of mandatory standards or requirements, but rather provide thresholds and indicators for key elements that represent desired conditions for the soil resource. The Region 5 standards also include threshold values for coarse woody debris (material greater than 3 inches in diameter. When the standards were written it was believed that coarse woody debris (CWD) contributed to soil productivity through nutrient recycling. Current science is finding that not to be the case; CWD does not contribute significantly to soil productivity in Sierra Nevada forests (Dr. Robert Powers, personal communication). Therefore, CWD is not used as an indicator for this analysis. Because neither of the action alternatives has the potential to impact soil buffering capacity, soil buffering capacity is also not used as an indicator for soils analysis in the South Shore project.

Impacts to soil hydrologic function would occur primarily as an indirect effect of impacts to porosity, so these indicators are discussed together. This analysis will also consider the potential for detrimental impacts to the soil resource from severe burning. The following soil quality indicators are used as the basis for this analysis and are defined and discussed below:

- Soil Porosity and Soil Hydrologic Function
- Effective Soil Cover
- Surface and Subsurface Organic Matter
- Severe Burning

Soil Porosity and Soil Hydrologic Function

Porosity is the space between individual soil particles. Maintenance of natural soil porosity is important for maintaining healthy native plant communities and for maintaining the hydrologic function of the soil. Soil compaction is a physical change in soil properties that results in a decrease in porosity and an increase in soil bulk density and soil strength (USDA Forest Service 1991). Potential direct effects of compaction include reduced movement of water and air through reduction in size, continuity, and total volume of pores, as well as a potential loss to soil structure as measured by a decrease in the size, strength, and number of soil aggregates. Potential indirect effects are multiple:

- Severe compaction can inhibit root growth when the soil becomes too dense for roots to penetrate easily; this may reduce both root and top growth.
- Compaction decreases infiltration and hydraulic conductivity, the movement of water into and through soils, which in turn increases surface runoff and erosion potential.
- Soil compaction decreases the transmission of water, nutrients, and air to roots.
- Conversely, with slight to moderate levels of compaction on coarse-textured soils, water storage may be increased, making water and nutrients available to plants throughout a longer period during the growing season (Gomez et al. 2002).
- Changes in moisture and aeration may reduce soil organism activity, reducing rates of nutrient and organic matter cycling.

Soil hydrologic function describes the ability of water to move into and through soils. Infiltration is the movement of water into soils, while hydraulic conductivity (sometimes called permeability) is the movement of water within soils. Soil hydrologic function is primarily controlled by physical soil properties such as texture, structure, and porosity. Soil texture, the relative distribution of sand, silt, and clay, is not affected by forest management activities. Soil structure, the arrangement of individual soil particles into aggregates, and soil porosity can both be impacted by forest management activities that cause compaction. Infiltration can also be reduced when the soil surface becomes hydrophobic (water repellent). Water repellency results when soil particles are coated with compounds derived from plant material decomposition or severe burning.

Effective Soil Cover

The presence of effective soil cover generally indicates that the soil surface is adequately protected from accelerated erosion. Effective soil cover is defined as live vegetative plant canopies, plant litter and duff, and rock fragments equal to or greater than ½ inch in diameter.

Surface erosion is the detachment and transport of individual soil particles by wind, water, or gravity (USDA Forest Service 1991). Accelerated erosion can impair site productivity and water quality. The topsoil (A horizon) is the most fertile and biologically active part of the soil profile due to its enrichment by organic matter in varying stages of decomposition. Loss of all or part of this horizon through erosion impairs the ability of the soil to support natural vegetation communities and often imparts a competitive advantage to non-native invasive species (weeds).

When eroded soil is deposited in water bodies it can impact water quality and aquatic habitats. Fine particles such as clays and colloidal organic matter can decrease the clarity of Lake Tahoe because they tend to remain in suspension rather than sinking to stream or lake bottoms. The discussion of erosion as it relates to water quality is found in the Water and Riparian Resources section of this chapter subsequent to this section.

Surface and Subsurface Organic Matter

Soil productivity, nutrient cycling, and pollutant filtering capacity are, in part, dependent on the chemical and biological properties of soils, especially organic matter. Decomposed subsurface organic matter has a role in aggregate formation and promotes the transfer of air and water through soils, provides nutrients that are available to plants, and increases water-holding capacity. Organic matter also serves as a major reservoir for terrestrial carbon.

Climate is usually the most important factor for controlling organic matter accumulation and decomposition under natural conditions, although organic matter is easily influenced by human activities because it is concentrated near the ground surface. Surface organic matter abundance is influenced by mechanical site disturbance, through thinning and harvest operation and by repeated foot or vehicle traffic. Thinning operations remove organic matter by removing vegetation that would otherwise decompose onsite; the amount removed depends on the intensity of treatment. Foot and vehicle traffic may pulverize organic matter, making it more susceptible to erosion by wind and water. Subsurface organic matter may be lost through erosion, soil displacement, or severe burning.

The current overly dense condition of most forest stands in the Lake Tahoe Basin may have produced thicker surface organic horizons than were present before the Comstock logging era. Larger amounts of carbon, nitrogen, phosphorous, and other nutrients may be present in forested ecosystems than under more natural conditions, so caution should be used in interpreting the impacts of present-day changes in surface organic matter on long-term site productivity.

Severe Burning

Severely burned soil is a condition where most woody debris and the entire forest floor are consumed down to bare mineral soil. A range of detrimental soil conditions may result: soil humus losses, structural changes, hydrophobic characteristics (water repellency), and sterilization are potential effects of severely burned soil. Soil may have turned red due to extreme heat; in wildfires in the Sierra Nevada, about 1-2% of the area may have severely burned soil (Ulery and

Graham 1993). Fine roots and organic matter are charred in the upper one-half inch of mineral soil (USDA Forest Service 1991).

The approximate temperature ranges for some heating effects are listed in Table 3-51 (Neary et al. 2005, DeBano et al. 1998, Ulery and Graham 1993). The degree of soil heating is dependent the duration of the fire and soil moisture. Large, concentrated fuel sources such as logs, stumps, or large slash piles burn longer and produce greater heat at greater depths than smaller, less concentrated fuels. Soil moisture limits soil temperature increases to about 95° C until all the water in the soil has been evaporated (Neary et al. 2005). Temperatures above 400° C are usually associated with reddened soil color resulting from chemical transformations of iron-containing minerals (Ulery and Graham 1993). Temperatures that alter clays and soil minerals are too hot to permit the formation of a water repellent layer (DeBano et al. 1998), so these impacts do not occur in the same place.

Fire produces changes in soils that affect plant growth. Humus losses alter nutrient contents. Intense soil heating can release some nutrients and temporarily increase the soil pH, changing nutrient availability in mineral soil. When soil microorganisms and invertebrates in the surface layers are killed, a wide variety of ecological services are decreased or suspended until these communities recover; this is sometimes described as sterilization.

Soil structural changes and water repellency impact soil-plant water relations and soil hydrologic function. Soil aggregate structure collapses when the organic matter that served as a binding agent is destroyed; this decreases porosity. If the soil surface is bare, raindrops may displace soil particles and ash, partially or totally sealing surface soil pores; which decreases infiltration, and increases surface runoff and erosion potential. Soil may be lost through erosion when large areas of bare mineral soil are exposed by fire, potentially impacting both soil productivity and water quality.

Table 3-51. Temperature ranges for changes in several soil properties

Heating Effect on Soils	Temperature Range
Lethal to living organisms	60° - 100° C
Subsurface organic matter destruction	200° - 400° C
Water repellency	176° - 288° C
Clay mineral alteration and mineral transformation	400° - 800° C

Existing Conditions

Soils in the project area developed from glacial and alluvial materials derived primarily from granitic rocks, but with some metamorphic and volcanic rocks (Saucedo 2004). Soils are generally coarse textured, with coarse sand, loamy coarse sand, and sandy loam surface layers. Hellhole and Watah soils are organic soils primarily derived from decomposed peat. The Tahoe and Bidart soils have organic surface layers derived from decomposed plants. Slope steepness ranges from 0-75%. Approximately 78% of the proposed treatment acres have slopes less than 30%; approximately 22% of the treatment acres have slopes greater than 30%.

The analysis area includes 92 soil map units. Each map unit usually includes two or more individual soil types, or components. The acres of each soil map unit in the proposed treatment units are listed in Table 3-56. Detailed information about the soils may be found in the soil survey of the Tahoe Basin area (USDA NRCS 2007). There are three areas within the project boundary that were not included in the Soil Survey. There are no treatment units in the largest area, which is the part of the Heavenly Ski Area permit boundary that extends outside the Tahoe Basin. The smaller areas are in treatment units southeast of Echo Lake . adjacent to the Eldorado National

Forest, and due to mapping inconsistency are within the LTBMU administrative boundary, but outside of the LTBMU soil survey and watershed boundary for streams that drain into the Lake Tahoe Basin. Soil type descriptions are the same as LTBMU soils inside the LTMBU watershed boundary.

Stream Environment Zone Soils

For the purpose of this analysis, the Tahoe, Watah, Marla, Bidart, Hellhole, and Celio soils, and the Beaches miscellaneous areas are considered stream environment zone (SEZ) soils. Beaches are associated with the shorelines of Lake Tahoe. This list of SEZ soils was compiled in consultation with TRPA and the Natural Resources Conservation Service (NRCS) for use in this analysis.

Watah and Hellhole are peat soils not suitable for mechanical treatment due to wetness and vegetation and habitat sensitivity. Hellhole soils are not located in the South Shore Project treatment units, and will not be discussed further in this analysis. The estimated acres of SEZ soils by treatment type are listed in Table 3-52. These acreages were derived by calculating the percentage of SEZ soil components in each map unit, summing them, and converting to acres for the treatment type.

While the composition of soil map units is highly accurate over the entire soil survey area, the relative proportion of soil components in any given delineation (mapped polygon) may or may not match the map unit composition. For example, a soil map unit may have an estimate of 20% SEZ soils, but the composition of soil map units is an average, therefore an individual delineation of that map unit on the ground may have a different percentage of SEZ soils. However, over the entire soil survey area, the map unit composition will be very close to 20% SEZ soils.

The proposed treatment units were mapped more precisely than the soil survey, so some slivers of SEZ soils appear to be present along the edges of some treatment units on the map which are not actually present in the units on the ground. This is the case for several units that are adjacent to the Truckee Marsh, as well as other parts of the analysis area. Thus it appears that the treatment units include wet soil types not suitable for mechanical treatment in most years on a GIS map, but in fact, these soils are excluded by the unit boundaries.

Table 3-52. Estimated acres of SEZ soils by treatment type for the project area

Alternative	Cut-to-Length	Hand Treatment	Whole Tree Yarding	Total
Alternative 2	448	87	198	733
Alternative 3	387	137	169	693

During the summer and fall 2007, the LTBMU forest soil scientist and an assistant traversed 72 proposed treatment units, comprising 2,728 acres. The selection of units for survey was purposeful; surveys were undertaken in units proposed for whole tree yarding and units where mechanical treatment of stream environment zones (SEZs) is proposed, because these treatment types generally pose a higher risk of soil impacts than hand thinning or cut-to-length operations outside of SEZs, as well as a higher risk of water quality impacts. Field surveys included five units proposed for mechanical treatment in Alternative 2 that were changed to hand thinning in Alternative 3 because these onsite evaluations revealed them to be too steep, too wet, or road access was inadequate (Table 3-53). The field surveys include two main kinds of information: (1) verification of the mapped soil type and (2) observations of impacts from past and ongoing activities.

Table 3-53. Summary of soil field surveys by proposed treatment type for the project area

Proposed Treatment Type	Number of Units	Acres
Cut-to-length	37	400
Whole Tree Yarding	29	2044
Hand Thinning	5	283

Soil verifications from the soil survey were used where available, where data collection points fell within a treatment unit. The soil mapping, which was done at a scale of 1:24,000, proved highly accurate. In a few instances, soil boundaries were off by 50-100 feet, but onsite soil descriptions nearly always fell within the range of the map unit description. Soil data points from the soil survey and from field surveys for this project are shown on the soil map in the appendix for the soil resources specialist report.

Obviously eroded or compacted areas were noted on 12 units. All were localized instances and most were small areas; 0.09 acre is largest area observed.

The area occupied by linear disturbance features such as user-created trails and non-system roads used for utility and sewer maintenance was estimated for each unit. These features add to the cumulative compacted and eroded surface area. Ocular estimates of linear disturbances are summarized in Table 3-54.

Table 3-54. Ocular estimates of linear disturbance features in the South Shore treatment units

Percent of Area with Linear Disturbance Features	Estimated Disturbed Acres	Number of Units	Total Acres Observed
<1%	0-9	42	918
1-5%	7-36	10	729
5-10%	31-62	11	618
>10%	>47	10	466

The USDA Forest Service Pacific Southwest Region also uses an interagency erosion hazard rating based on site-specific observations (FSH 2509.22). These ratings were completed for the units proposed for whole tree harvesting, since that harvest system is more likely to result in the greater amount of bare mineral soil susceptible to erosion, and recent monitoring has not shown detrimental erosion in most cut-to-length units. Units were rated in areas with conditions typical for the unit. This rating considers soil erodibility factors, runoff production factors, a runoff energy rating, and soil cover factors. All of the 19 units rated had a low erosion hazard rating, based on their current condition. Aside from the eroded areas noted above, most of the proposed treatment units currently have ground cover adequate to prevent accelerated erosion.

Soil Interpretations

Soil interpretations are useful for making general predictions about the suitability of soils in a given area for a proposed activity or predictions about the possible degree of impacts to soils from an activity or an event such as wildfire. The soil interpretations employed in this analysis are from the soil survey (USDA NRCS 2007) and include potential for fire damage to soils, suitability for use of harvesting equipment, hazard of off-road or off-trail erosion, and soil rutting hazard. The interpretations in this analysis are based on the rating of the dominant component of the soil map unit. The dominant component often comprises 80% of the map unit, but ranges from 40% to 100%.

The potential for fire damage to soils interpretation includes all soils in the analysis area, including those not proposed for treatment. The suitability for use of harvesting equipment and soil rutting hazard interpretations include only acreage proposed for mechanical treatments. The hazard of off-road or off-trail erosion rating includes all acreage proposed for treatment.

The acreages in the interpretation tables are less than the total treatment acreages for two reasons: (1) about 59 acres proposed for cut-to-length treatments are outside the soil survey boundary, and (2) about 200 acres are not rated in the soil survey because the dominant map unit is not a soil. Such map units most commonly have rock outcrop or rubble land as a dominant component, but also include the urban land and pits and dumps units. Soils with rock outcrop or rubble land as a dominant component nearly always receive hand treatment due to equipment limitations. There are no delineations of urban land or pits and dumps in the proposed treatment areas.

For this analysis, sensitive soils are identified through soil interpretations. Soils with severe or very severe limitations for mechanical harvest or a high hazard rating for erosion, rutting, or damage from wildfire are considered sensitive, and are discussed below.

For the mechanical harvest interpretation, the sensitive soils (soils with “poorly suited” ratings) have two major kinds of limitations: high moisture content and high rock fragment content. The soils limited by moisture content are map units 7041, 7042, and 7071 (Table 3-54). Map unit 7071 is primarily mapped in three treatment stands. The portions of these stands with the Watah peat generally do not support many conifers, and would be excluded from mechanical treatment because they are too wet. The soil survey limitations to equipment use are different from the TRPA designation for SEZ areas. Both the soil survey and SEZ designations are used in analysis of effects.

Tahoe soils are primarily mapped in stands 169, 170,211, 212, 215, 269, and several of the urban lots along the Upper Truckee River. Portions of these units may be too wet for mechanized operations during some or all of most years. The soil moisture chart (found in the soil scientist’s report in the project file) would be used to determine whether soil moisture is suitable for mechanized harvest operations before operations could begin.

The soils limited by high rock fragment content are the Meeks and Dagget soils in map units 7484, 7485, 7486, 7488, 9404, and 9405.

Table 3-55. Selected soil interpretations for the South Shore project

Map Unit Symbol	Map Unit Name	Poor Suitability for Mechanical Harvest Equipment	High Hazard of Soil Rutting	Alternative 2 Acres		Alternative 3 Acres	
				Cut-to-Length	Whole Tree	Cut-to-Length	Whole Tree
7041	Tahoe complex, 0 to 2 percent slopes	x	x	186	20	125	11
7042	Tahoe complex, 0 to 5 percent slopes, gravelly	x	x	25	9	31	2
7071	Watah peat, 0 to 2 percent slopes	x	x	19	0	15	0
7484	Meeks gravelly loamy coarse sand, 5 to 15 percent slopes, extremely bouldery	x		110	102	84	46
7485	Meeks gravelly loamy coarse sand, 5 to 30 percent slopes, extremely bouldery	x		79	184	42	92
7487	Meeks gravelly loamy coarse sand, 5 to 15 percent slopes, rubbly	x		3	96	1	7
7488	Meeks gravelly loamy coarse sand, 15 to 30 percent slopes, rubbly	x		119	106	83	0
9404	Dagget very gravelly loamy coarse sand, moist, 5 to 15 percent slopes, rubbly	x		0	8	0	8
9405	Dagget very gravelly loamy coarse sand, moist, 15 to 30 percent slopes, rubbly	x		0	10	0	10

Ruts are an indicator of compaction, and rutting can displace duff and topsoil. Ruts can also channel water, which concentrates runoff and increases the likelihood of erosion. This interpretation is included as a surrogate for a compaction hazard rating. The hazard is described as slight, moderate, or severe, and the ratings are based on soil properties of the dominant map unit component when soil moisture is at or near field capacity. A rating of "severe" indicates that ruts form readily, and is used to indicate sensitive soils.

Since mechanical operations would not be allowed when soil moisture is at or near field capacity, the “severe” rating is used to identify the soils that are “sensitive” to rutting under the soil moisture conditions acceptable for mechanical operations (see design features). The soils rated “severe” are map units 7041, 7042, and 7071. Map units 7041 and 7042 are primarily wet meadows with few trees. Where there are trees proposed to be removed on these soils, moisture will be the most limiting factor, and will limit mechanical operations. Areas with Watah peat soils (7071) would be flagged and avoided.

The NRCS erosion hazard rating from the soil survey is based on slope steepness and soil erodibility (K factor). The rating assumes 50 to 75 percent of the surface has been exposed by disturbance, causing sheet or rill erosion in off-road or off-trail areas. Erosion hazard is described as slight, moderate, severe, or very severe. A rating of slight indicates that erosion is unlikely under ordinary climatic conditions; moderate indicates that some erosion is likely and that erosion-control measures may be needed; severe indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and very severe indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Like most erosion hazard ratings designed for broad scale application, this rating does not include slope length. Along with slope steepness and surface roughness, slope length controls runoff velocity, thereby controlling the erosive energy of runoff and the ability of the runoff to detach and move soil particles. An erosion hazard rating is less accurate and meaningful without slope length, but it is very difficult to include slope length over a broad area because it is so variable. Erosion hazard rating must also be considered in light of the design features of the proposed project; no treatment unit would be left with 50-70% disturbed bare mineral soil on the surface. For this analysis, the “Severe” and “Very Severe” categories are considered the soils that are “sensitive’ to erosion. The soil limitations for this rating are slope and erodibility; soils with an erodibility factor for the soil including rocks (Kw) $\geq$ 0.35 and slope >26% are rated “Severe” or “Very Severe.” The numbers of acres with a “Severe” or “Very Severe” erosion hazard rating are nearly the same for Alternative 2 and Alternative 3 for each map unit, with a total of 35 more acres for Alternative 2 than for Alternative 3 (Table 3-56). No treatments would be implemented on the Watah peat, map unit 7021; this soil would be flagged and avoided. The remaining map units in the table almost exclusively have slopes greater than 30%. The vast majority of these areas would be treated by hand. Where small areas with slopes greater than 30% are present in mechanical treatment units, equipment would not drive on these steeper slopes. Instead, equipment would reach in and remove the trees, or trees would be hand felled and endlined out of the steeper areas.

Table 3-56. NRCS soil survey interpretation for hazard of off-road or off-trail erosion for proposed treatment units in the South Shore project

Map Unit Symbol	Map Unit Name	Acres rated "severe" or "very severe"		
		Project Area	Alternative 2	Alternative 3
7021	Hellhole peat, 0 to 2% slopes	288	0	0
7123	Ellispeak-Rock outcrop complex, 50 to 70% slopes	26	0	0
7232	Waca very gravelly medial coarse sandy loam, 30 to 50% slopes	75	17	17
7413	Cagwin Rock outcrop complex, 30 to 50% slopes, extremely stony	2,441	435	435
7414	Cagwin-Rock outcrop complex, 50 to 70% slopes, extremely stony	605	111	107
7423	Cassenai gravelly loamy coarse sand, 30 to 50% slopes, very stony	1,433	201	201
7424	Cassenai gravelly loamy coarse sand, 50 to 70% slopes, very stony	521	51	51
7427	Cassenai cobbly loamy coarse sand, moist, 30 to 50% slopes, very bouldery	850	3	3
7428	Cassenai cobbly loamy coarse sand, moist, 50 to 70% slopes, very bouldery	669	36	36
7486	Meeks gravelly loamy coarse sand, 30 to 70% slopes, extremely bouldery	964	448	431
7489	Meeks gravelly loamy coarse sand, 30 to 70% slopes, rubbly	1,323	215	207
7511	Shalgran-Rock outcrop complex, 30 to 75% slopes	265	23	23
7523	Tallac gravelly coarse sandy loam, 30 to 70% slopes, very stony	1,142	423	423
7532	Toem-Rock outcrop complex, 30 to 50% slopes	361	138	138
7533	Toem-Rock outcrop complex, 50 to 70% slopes	117	0	0
9102	Callat very gravelly coarse sandy loam, 30 to 50% slopes, very stony	407	11	11
9131	Lithnip-Meiss-Hawkinspeak association, 30 to 75% slopes	2,233	0	0
9142	Melody-Rock Outcrop complex, 30 to 50% slopes	78	0	0
9143	Melody-Rock outcrop complex, 50 to 70% slopes	94	0	0
9162	Sky gravelly sandy loam, 30 to 50% slopes	91	0	0
9165	Sky-Melody complex, 30 to 50% slopes	41	0	0
9171	Mountrose-Wardcreek-Melody complex, 50 to 70% slopes	34	0	0
9402	Dagget very gravelly loamy coarse sand, 30 to 50% slopes, extremely bouldery	1,488	0	0
9403	Dagget very gravelly loamy coarse sand, 50 to 70% slopes, extremely bouldery	497	0	0
9406	Dagget very gravelly loamy coarse sand, moist, 30 to 70% slopes, rubbly	390	63	56
9407	Dagget-Rock outcrop complex, moist, 30 to 70% slopes	581	30	30

9411	Freelpeak-Windyridge-Rock outcrop complex, 15 to 75% slopes	444	0	0
9443	Temo-Witefels complex, 30 to 50% slopes	3,042	14	14
9444	Temo-Witefels complex, 50 to 70% slopes	1,510	31	31
9451	Waterpeak-Rock outcrop complex, 30 to 75% slopes	594	0	0
9461	Whittell-Jobsis-Rock outcrop complex, cool, 30 to 75% slopes	4,252	0	0
	Totals	26,855	2,249	2,214

The NRCS soil survey interpretations also rate the potential for fire damage to soils. "Low" indicates that the soil has features that reduce its potential for fire damage. "Moderate" indicates that the soil has features that result in a moderate potential for fire damage, with one or more soil properties in a less than desirable condition. "High" indicates that the soil has one or more properties that result in a high potential for fire damage. The ratings are based on soil properties of the dominant map unit component. Ratings are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires of moderate intensity (116-520 btu/sec/ft) that provide the necessary heat to remove the duff layer and consume organic matter in the surface layer. A high intensity fire would produce greater impacts and a low intensity fire would produce lesser impacts than predicted by this interpretation.

The numbers of acres in each hazard class for the entire project area are listed in Table 3-57. Impacts to soils from the proposed action would be almost entirely limited to the treatment units, but impacts from a wildfire could potentially impact any part of the project area.

Table 3-57. NRCS soil survey ratings for potential for fire damage in the project analysis area

Rating	Acres
High	13,442
Moderate	55,677
Low	5,966
Not Rated*	15,996

* Several map units were not rated because they do not have a soil as the dominant component.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Under Alternative 1, no new management actions are proposed so no new soil effects would occur. Past and ongoing management activities and uses, such as previous vegetation management activities, and road and trail use, utility corridor use, would continue to affect soil resources. None of these uses would significantly impact the soil resource.

Potential for Soil Impacts from Wildfire

Potential impacts to soils in the event of wildfire include severe erosion, loss of nutrients and organic matter, reduced infiltration, and destruction of soil macro- and microorganisms. Effects to soil resources from the No Action alternative would be expected to be similar to the 2002 Gondola Fire which resulted in significant soil loss from erosion. Short term effects also included significant increases in soil solution concentrations and/or leaching of mineral forms of nitrogen, sulfur, and phosphorous. The most significant long term effect was the loss of ecosystem nitrogen from the forest floor (Murphy et al. 2006). The geographic extent of wildfire impacts would depend on the fire, but impacts to soils would likely be distributed unevenly within the fire perimeter, and their severity would be variable.

The impact to soils from wildfire in the proposed treatment areas would likely be greater under Alternative 1 than under Alternative 2 or 3 (see Fire and Fuels report for details and analysis). The effectiveness of fuels treatments similar to what is being proposed was demonstrated by post-wildfire analysis of the Angora Fire (Murphy et al. 2007). This report found that most of the area fuel treatments reduced fire behavior from a crown fire to a surface fire. Because less heat is generated in a surface fire than in a crown fire, surface fire impacts to soils are generally less than crown fire. Similarly, reducing crown fuels was found to moderate extreme fire behavior in four different ecosystem types across the United States. An important feature these sites had in common was historical short fire return intervals, a feature also shared by the Tahoe basin (Omi and Martinson 2002).

Alternatives 2 and 3

Soil resource impacts would be similar in nature under either action alternative, but a smaller area would be impacted under Alternative 3 than under Alternative 2. Acres of mechanical treatments and landings would decrease, and acres of hand treatments would increase. The area impacted by temporary road construction and reconstruction of existing closed roads would decrease.

To provide a clear comparison between the action alternatives, and reduce repetitive text, the action alternatives will be compared in the following discussion of effects for types of activity and soil indicators of effects. Road construction and maintenance, mechanical tree removal, and prescribed fire are the activities that have the potential to directly and indirectly affect soil resources, and will be discussed below for the soil impacts indicators.

Road Construction, Use, and Maintenance

Under Alternative 3 there would be about 5,114 feet less new temporary road construction than under Alternative 2. Assuming a road width of 15 feet, this means 1.76 fewer acres of soil would be subject to compaction and loss of hydrologic function resulting from new road construction under Alternative 3. Project design features and BMPs would mitigate losses of effective cover with the potential to cause accelerated erosion, so potential impacts would be similar for both action alternatives. Of concern for this analysis would be surface and subsurface organic matter losses from new construction of temporary roads and from reconstruction of existing closed roads. New temporary road construction would impact 1.8 fewer acres of soil and reconstruction of existing closed roads would impact about 3.1 fewer acres under Alternative 3 than under Alternative 2.

Soil Porosity and Hydrologic Function

Soils affected by permanent road construction and maintenance are removed from productive status; these soils are not dedicated to growing vegetation because they are a part of the permanent transportation system. Maintaining soil porosity on permanent roads is not an objective.

Compaction beyond existing conditions would take place on new temporary road construction. Existing closed roads that would be reconstructed would experience some degree of additional compaction, especially along the edges where vegetation has begun to encroach on the road prism and porosity has begun to recover as a result. Road maintenance before and during the project would have minimal effects on porosity.

All temporary roads will be closed and stabilized. New temporary roads on soils with low rock content would be decommissioned. Decommissioning would be accomplished by ripping compacted soils, and mulching and or seeding areas of soil disturbance. Thus, new temporary road construction would create short term impacts to soils, but decommissioning would facilitate recovery of soil productivity over the long term. New temporary roads on rocky soils would not be ripped, as this tends to leave an unacceptable amount of loose soil subject to erosion, they would receive soil cover from chips or masticated material, as described in Chapter 2. The decision of whether a temporary road would be ripped or not is a qualitative decision that would be made site by site; roads having 30-40% rock generally are not suitable for ripping. Soils likely to have rock content that would make them unsuitable for ripping include the Meeks soils in map units 7484, 7485, 7487, 7488, and the Dagget soils in map units 9404 and 9405.

Effective Cover

Maintenance of effective soil cover protects soil productivity by helping to prevent accelerated (human-caused) erosion. While maintaining soil cover on roads that are being used is not an objective, limiting accelerated erosion from roads is an important objective for maintaining soil productivity in areas receiving runoff from the road surface. Concentrated runoff from road surfaces has the potential to cause rilling and gullying, resulting in loss of topsoil and the potential for sediment deposition into water bodies.

Cut and fill construction methods cause soil disturbance on areas adjacent to the road prism, extending the disturbance area. Structures to control runoff from the road surface may also add to the disturbed area. On forest roads, the design width is typically about 15 feet. When cut and fill slopes are required, the area of disturbance would be greater than the width of the road surface. Road construction proposed in this project would avoid cut and fill wherever possible in order to minimize soil disturbance. By following the contours of the slope, cut and fill would not be needed, temporary roads would be less noticeable and less likely to attract recreation use, and decommissioning would be more effective to mitigate disturbance. Effective cover would be restored on temporary roads when they are decommissioned at the end of their period of use, and include the application of chips or masticated material.

Temporary reconstruction of currently closed roads would result in impacts similar in nature to new construction, but of lesser magnitude. Reconstruction activities would vary by road segment, but could include restoring the original road prism, grading and stabilizing the surface, and installing drainage structures. Upon project completion, these roads would again be closed as they were prior to the project, stabilized to control surface runoff, and returned to the use category prior to the project (See transportation section for additional details). Impacts to soils would persist for a longer period of time on these roads than on the new temporary roads, depending on their designated use category. Soil impacts would return to the level prior to use for the project, whether that designated use is an OHV trail, or hiking trail.

Heavy equipment tends to pulverize the soil surface, destroying soil structure and leaving a powdery surface layer that is susceptible to erosion by wind and water, and soil structure recovery would be a long term process. Wetting the road surface during periods of heavy use would be required, and would help prevent erosion. BMPs for permanent and temporary roads would be required, and road surface stabilization and drainage structures would be installed and maintained to reduce impacts to soil resources.

Organic Matter

Surface organic matter would be largely absent from road surfaces; maintaining surface organic matter is not an objective for roads that are in use. Some subsurface organic matter would be removed through road construction, reconstruction, and maintenance; the amount removed would depend on the type of activity, with cut and fill construction removing the most and maintenance grading removing the least. Retaining subsurface organic matter is not an objective on roads that are a permanent part of the transportation system. Thus, the organic matter losses that are of concern for this analysis are surface and subsurface organic matter losses from new construction of temporary roads and from reconstruction of existing closed roads; none of these areas are part of the permanent transportation system.

On newly constructed temporary roads, some surface organic matter would be replaced by chipped or masticated material when the roads are closed at the end of the project. The amount of surface organic matter replacement would likely be less than the original forest floor, but in some cases might be the same or more. This material would be coarser than the forest floor that was removed, and would take longer to decompose. Thus, replacement of subsurface organic matter by humus derived from this material would likely take more than a few years; subsurface organic matter loss would be a long term impact for the temporary roads. Surface and subsurface organic matter removal would be a long term impact for the reconstructed closed roads.

Mechanical Treatments

Alternative 3 would increase the number of acres of hand treatments and CTL treatments and decrease the number of acres of whole tree yarded treatments over those proposed in Alternative 2, and the acres of different types of fuel treatments would change as well (Chapter 2). The shift from whole tree to CTL and hand treatments would decrease overall soil disturbance.

The potential for impacts to soil porosity and soil hydrologic function would be greatest on landings and skid trails of whole tree yarded units. Assuming 10-15% of the unit is disturbed by skid trails, about 165-250 fewer acres would be impacted by skid trails under Alternative 3 than under Alternative 2. Likewise, fewer landings would be required for Alternative 3 than for Alternative 2: 100-150 acres for Alternative 3 versus 150-200 acres for Alternative 2. The increase in hand and cut-to-length treatments and the corresponding decrease in whole tree yarded treatments in Alternative 3 would result in a decreased potential for impacts to soil porosity and soil hydrologic function. However, the potential for compaction and the resulting loss of porosity is greatly decreased by operating on dry soil, so the difference between the alternatives is a difference in risk.

Construction of water bars would limit erosion and resulting loss or displacement of topsoil, so again, the difference between the alternatives is a difference of risk. Fewer acres would be dedicated to skid trails under Alternative 3 than under Alternative 2, so the risk of erosion due to lack of effective cover would be lower. Similarly, the acres receiving cover of chips or masticated material would be greater under Alternative 3 than under Alternative 2. The potential for erosion in SEZs where logs would be end-lined out would also be less under Alternative 3 than under Alternative 2.

Surface organic matter would be replaced through chipping and mastication on 137 more acres under Alternative 2 than under Alternative 3. Fewer landings would be required, so organic matter disturbance and replacement by chipped or masticated material on landings would be decreased by about 50-100 acres under Alternative 3.

Soil Porosity and Hydrologic Function

Two types of logging systems would be used: cut-to-length harvester and forwarder (CTL) and whole tree yarding, using conventional harvesting and skidding equipment (WT). These systems are described in Chapter 2 of the EIS.

In CTL units, soil porosity would be diminished on harvester and forwarder trails and on landings. These losses would be greatest on landings and forwarder trails, and least on harvester trails. Informal monitoring on past projects has shown that the total amount of area impacted by harvest equipment was slightly less than 15% (Scott Parsons, Ray Machado personal communication). However, formal monitoring demonstrated that the loss of porosity on forwarder trails was 2.48% and 12.07% on landings (though only 2 data points were available on landings (USDA Forest Service LTBMU 2007). No significant difference was measured between tracked and non-tracked bulk densities in the Heavenly SEZ project (USDA Forest Service LTBMU 2008). Thus, it is likely that slightly less than 15% of the activity area would be disturbed by CTL operations, but the detrimentally disturbed area would be considerably less than 15% because much of the disturbance would be below the porosity threshold.

In WT units, soil porosity would be diminished on skid trails and on landings. Impacts would be greatest on main skid trails and on landings. WT systems are more effective at reducing wildfire hazard because the potential fuels are all brought to the landings as opposed to CTL systems, which distribute much of the fine fuels throughout the unit as slash mats.

Soil disturbance in WT units would be more extensive than in CTL units. In a field-based comparison of WT and CTL systems, the WT system used a larger area than the CTL system (25% vs.20%). Forwarders tended to drive in the tracks created on previous trips, leaving the center of the trail relatively unimpacted, while skidders tended to not use the same tracks during repeat trips on a given trail because the skidded logs erased the previous tracks. This resulted in a wider average trail width in the WT unit (4.55 m) than that in the CTL unit (3.62 m), although trail length did not differ significantly between the two systems (Han et al. Unpublished). In addition, soil compaction is often more severe in WT units than in CTL units (McNeel and Ballard 1992; Lanford and Stokes 1995). Where slash is available, the forwarder used in the CTL system drives on a slash mat, which cushions the soil, absorbing some of the ground pressure and vibration from the equipment. The effectiveness of the slash mat is a function of its thickness and the number of times it is driven over (breakage reduces effectiveness). Thus, overall impacts to soil porosity would be greater on the whole tree (WT) units than in the cut-to length (CTL) units.

Minimizing compaction is the most effective strategy for maintaining soil porosity. Operating on relatively dry soils and limiting areal extent of equipment traffic are highly effective preventive strategies. Operating on less sensitive or low risk sites is also very effective. Soils with low risk characteristics can tolerate greater variety of equipment and operating conditions (moisture) than high risk soils (Miller et al. 2004). Compaction is inhibited on rocky soils because compaction is limited when subsurface rocks are pushed against each other

Project area soils sensitive to compaction are the Tahoe and Watah soils in mapunits 7041, 7042, and 7071. Design features to minimize compaction include operating on dry soils (defined in Table 1 of Appendix 3 in the soil scientist’s report), and using designated skid trails to limit the extent of equipment traffic. CTL equipment would operate on Tahoe soils if conditions are dry enough, but Watah soils are usually associated with special aquatic features and would therefore be equipment exclusion zones. Heavy equipment would be excluded from SEZs in WT units, so heavy equipment would not operate on Tahoe and Watah soils in WT units.

Surface soils tend to recover relatively quickly from compaction, but subsoil compaction may persist for decades, so loss of porosity is generally considered a long term impact (Sands et al. 1979; Froehlich et al. 1985; Tiarks and Haywood 1996). Slight recovery may occur after 5-10 years (Page-Dumroese et al. 2006; Powers et al. 2005). Recovery rates may vary with repeated disturbance, soil moisture during equipment operation, soil texture, and rock fragment content (Miller et al. 1996; Williamson and Neilsen 2000; Liechty et al. 2002). Soil variability within a site tends to be high, making interpretation of results difficult. Given these many factors, it is difficult to predict when compacted soils would recover to within regional soil quality threshold values.

Effective Cover

Effective soil cover would decrease in mechanically treated stands on skid trails and landings in WT units and to a lesser degree on harvester and forwarder trails and landings in CTL units.

SEZ treatments in WT units would consist of endlining (dragging) logs out of SEZs. This would displace soil in the path where the logs are dragged and would leave loose, bare soil on the surface. Additional effective cover would be provided by branches and tops of cut trees, which would be scattered onsite. Design features to mitigate loss of effective cover include (1) to the extent practicable, where slopes exist above 10% endline material along slope contours (i.e. cross-slope) to avoid creating ruts in the soil going downhill and (2) if ruts are created during endlining operations, provide ground cover over the ruts by spreading slash, and if ruts could deliver sediment to streams, they would be filled in by hand-raking. Implementation of these design features would provide adequate effective cover to reduce impacts to soils within SEZs in WT units. Implementation of these design features would provide adequate effective cover in SEZs in WT units.

Cover would be restored to landings through chipping or mastication of slash, but in WT units, soil under landing piles would experience an additional loss of soil cover after burning, which would take place at least one year after treatment. Skid trails in whole tree units would be left without adequate effective cover until the autumn following operations, when needle cast would begin to replace cover removed or displaced by treatment activities. To control surface runoff, water bars would be installed on skid trails according to standard Forest Service specifications (see Chapter 2 design features). Outside of landings, effective soil cover is normally restored to levels adequate to prevent most accelerated erosion within one to two years after treatment as conifer needles drop in the fall.

Organic Matter

Mechanical treatments would alter the quantity and quality of surface organic matter, but would have little effect on subsurface organic matter. Surface disturbance from heavy equipment operation would displace surface organic matter. Material would be crushed by equipment, and some finer material would be pulverized, making it more susceptible to erosion. Limited amounts of subsurface organic matter would be displaced when harvest equipment displaces soil on turns. Displaced organic matter would be moved short distances and these changes in themselves would not negatively impact the productivity of soils in the activity area.

In CTL units, organic matter would be displaced on harvester and forwarder trails in areas where little slash is available and on harvester and forwarder trails in SEZs (equipment would remove all slash from SEZs). Slash would be chipped or masticated and spread over the soil surface throughout all non-SEZ units, and on all landings. While mastication and chipping are primarily slash disposal methods, there is an added benefit for erosion control by providing interim soil cover and organic matter. The amount of organic replacement would depend on the amount of slash available, with a maximum depth of 6 inches. In past projects, ground cover after chipping or mastication has often been close to 100% (USDA Forest Service LTBMU 2007) and is often thicker than the original forest floor. The chipped or masticated material would differ from the forest floor. Chipped or masticated material would have more carbon, more lignins and other compounds that slow decomposition, and lower nitrogen and other nutrient content than the naturally-occurring duff.

In WT units, surface organic matter would be displaced on skid trails and on landings. Surface organic material lost from landings in WT units would be replaced by chipped or masticated material. Limbs and branches would be spread in SEZs, up to the point when the fuel loads reach 15 tons per acre. In addition to providing effective cover where soil is disturbed by endlining, this material would replace surface organic matter.

There would be a net loss of potential surface and subsurface organic matter in all units due to the removal of vegetation. Thinning is proposed in order to reduce stand density to conditions more appropriate to the ecosystem, so this loss would not be a significant detriment to soil quality.

Hand Treatment

Effects on soil porosity, hydrologic function, effective cover, and surface and subsurface organic matter would be present on 1,045 more acres in Alternative 3 than Alternative 2. Of these, 51 acres would be in SEZs and 994 acres would be in upland areas. The nature of the impacts is insignificant, and the increase in acres would not result in a significant impact to the soil resource.

Soil Porosity and Hydrologic Function

Hand thinning, piling, and burning slash would result in minimal soil disturbance. The only impacts to porosity would be from workers walking; this would not result in meaningful impacts to vegetation growth, soil water relations or soil aeration.

Effective Cover

Minimal disturbance to the soil surface would result from hand treatments. Cutting trees and brush and dragging them to pile locations would not decrease effective soil cover enough to increase erosion potential.

Organic Matter

Hand falling and piling would not affect surface and subsurface organic matter. Surface and subsurface organic matter would only be affected by pile burning, discussed below.

Prescribed Fire

Prescribed fire includes burning of hand piles, landing piles, and underburning. Effects on soil porosity, hydrologic function, effective cover, and surface and subsurface organic matter would be present on 1,045 more acres in Alternative 3 than Alternative 2. Of these, 51 acres would be in SEZs and 994 acres would be in upland areas.

Overall, soil impacts from prescribed fire would be similar under both action alternatives. Impacts to soils due to prescribed fire would probably be present after burning most landing piles in WT units, but would be present only occasionally under hand piles. Thus it is likely, but not certain that these impacts would be decreased in Alternative 3 as compared to Alternative 2 because the decrease in WT units means a decrease in landing piles. This decrease would be offset to some degree by the increase in hand piles, but the vast majority of hand pile burns would not result in detrimental soil effects. The decrease in underburning would not result in a meaningful difference in impacts between the two action alternatives.

Soil Porosity and Hydrologic Function

Underburning and slash pile burning would have minimal effects on soil porosity. Potential impacts would be loss of surface soil aggregate structure and clogging of soil pores by ash. These effects would be limited to the pile footprints for slash piles and would likely occur under most large landing piles and under a few hand piles. In underburns, these effects would be limited in area to soils under the occasional log or stump that burns for an extended period of time.

Effective Cover

Pile burning in hand treatment units would not decrease effective soil cover within the unit to levels that would result in accelerated erosion, and cover losses would be a short term impact. Cover would be removed through burning of piles; observations of past treatments indicate an estimated 5-6% of the treatment unit area would be covered by piles (Rita Mustatia; personal communication). Burn pile footprints often have a concave surface that retains water.

If conditions are adequate to ensure control, prescribed fire may be allowed to creep beyond the edge of hand piles in order to remove additional surface fuels (also referred to as a “backing” fire, especially when moving downhill). This would result in some additional loss of cover, but this low intensity burning rarely consumes the entire forest floor, and usually leaves some cover in place. Effects of letting the fire creep adjacent to the piles would be similar to the effects from underburning, and usually causes fewer impacts to soil than construction of fire lines around burn piles.

No prescribed fire is proposed for CTL units. Loss of effective cover from prescribed fire in WT units without underburning would be limited to the area covered by landing piles.

Effects of underburning are estimated by the FOFEM (First Order Fire Effects Model), which predicts that under Jeffrey pine, duff levels would be reduced from 5cm to about 2.5 cm, and about 31% of the mineral soil surface would be exposed. Limitations of this model are discussed in the fire and fuels report. Effects of underburning in SEZs would be non-significant because flame heights would be carefully controlled and burning would take place under moist soil conditions.

Organic Matter

In hand treatment units, surface organic matter would be removed through pile burning and light burning of the forest floor associated with pile burning as described in the Effective Cover section. These would be minor losses due to the relatively small area affected by pile burning. Soil temperatures under burning piles would vary with soil moisture, pile size, and the diameter of the material in the piles, creating a range of impacts. Larger piles and larger diameter material would result in higher soil temperatures at greater depths than smaller piles and smaller diameter material. Fire allowed to creep beyond the piles would cause incomplete combustion of the forest floor.

Virtually no subsurface organic matter would be lost from these units; extremely minor losses might occur under some piles if subsurface temperatures are high enough, but this is unlikely. Surface and subsurface organic matter losses would be less in hand treatment units than in mechanical treatment units.

No prescribed fire is proposed for CTL units. As described in the effective cover section, surface organic matter would be lost under landing piles. Landing piles would generate enough heat in some cases to burn organic matter in the upper part of the surface soil horizon as well. These losses would be limited to the pile footprint.

Severe Burning

The risk for severe burning effects to soils under either action alternative is considerably less than the No Action (Alternative 1), because the effect would be limited to the footprint of the burn piles rather than the more widespread effects that could occur under Alternative 1.

Hand Treatments

Hand piles occasionally burn hot enough to create a water repellent layer and destroy some subsurface organic matter, but rarely get hot enough to alter clay minerals. Usually, some unburned material is left in the pile footprint. When soils under hand piles are severely burned, effects are short-term. Soil water repellency may begin to weaken in as little as 3 months and may persist for 1-2 years (Huffman et al. 2001). It is possible that the soil would be detrimentally burned under some hand piles, and roots, seeds and soil microorganisms would likely be destroyed in the upper part of the surface horizon.

Mechanical Treatments

Most of the studies on detrimental burning under slash piles involved the burning of large piles such as those that would be created on the landings in WT units. Temperatures lethal to soil organisms and plant roots could penetrate as deep as about 15-20 inches (Neary et al. 2005). Soil water repellency would be more common in landing pile burns than in hand pile burns. Destruction of soil structure and clay mineral alteration would be likely in surface layers of some pile footprints. Clay mineral alteration is an irreversible impact, but would be limited in extent and would not significantly impact soil productivity.

Underburning would not be likely to cause detrimentally burned soil. The FOFEM predicts that surface and subsurface temperatures would remain below 60°C. Limitations of this model are discussed in the fire and fuels report. Underburning may improve microbial response to wildfire. When a moderate intensity wildfire burned ponderosa pine forest, the microbial biomass in soils was nearly twice as great in soils subjected to prescribed fire three months earlier than in soils without prescribed fire (Choromanska and DeLuca 2001).

Losses of nitrogen and phosphorus from prescribed fire would offset the long term effects of fire suppression. Preliminary modeling by the University of Nevada, Reno suggests that levels of nitrogen, and phosphorus are higher than they were when fire was not suppressed in the Tahoe Basin.

Oversnow Mechanical Treatment

Implementation of this treatment would be dependent on snow and weather conditions; it is not known if it would be implemented under either action alternative. Because of this, the extent of impacts is unknown but would be similar under both action alternatives.

This type of treatment would have minimal effects on the soil resource because it would be implemented with over snow design features (Chapter 2) and BMPs for winter road use. There would be little to no soil compaction, so impacts to porosity and soil hydrologic function would be insignificant. Heavy equipment operation would not disturb the soil surface, so effective cover and surface and subsurface organic matter would not be affected. The associated fuels treatment would be piling and burning slash; effects associated with these activities would be similar to those described for piling and burning above.

Cumulative Impacts

Alternative 1 (No Action)

The No Action alternative could result in significant impacts; it could result in greater impacts to the soils resource than either of the action alternatives if a wildfire burned through untreated forest stands, but the impacts would depend on the extent and severity of the fire. Because the extent and severity of a wildfire are not predictable, and the No Action alternative without wildfire is also not predictable, no direct or indirect effects are measurable or predictable. Therefore, there are no measurable or predictable cumulative effects.

Alternative 2 (Proposed Action) and Alternative 3

Cumulative effects to the soil resource would be limited to the proposed treatment units, as discussed above. Previous vegetation treatments and recreational activities contribute to cumulative effects to the soil resource. For vegetation treatments, cumulative effects would be present where previous activity areas overlap proposed activity areas. Evidence of past treatments is evident in the project area; occasional skid trails that may date to the 1950s and 1960s were encountered. These skid trails are apparent because the soils are compacted.

The approximate acreage of past treatments for the past 10 years is known on a watershed basis, but it has not been possible to calculate the extent of overlap with the proposed treatment units. The Pioneer hazard reduction project (as modified), Angora hazard reduction, Tahoe Mountain timber sale, Spring Creek summer home tract, Camp Shelley hazard reduction project, and the Cathedral fuel reduction and Aspen habitat enhancement project overlapped treatment units proposed in this project (Table 3-58). Most of the overlapped areas are either SEZs that were not treated previously because of equipment restrictions or hand treatment units in which it was not possible to reduce fuels to current desired conditions. The Angora project was a salvage sale in which the primary objective was to remove trees killed by bark beetles, so fuel levels are still above desired conditions. An estimated 400 acres of tractor skidded ground treated in the Tahoe Mountain Timber Sale and about 400 acres of CTL and over snow treatments in the Spring Creek/Camp Shelly project would be treated again in the proposed project. Few extensive areas of compacted or eroded soils were observed during pre-project surveys, so it is unlikely that cumulative impacts to soils from previous vegetation treatments would exceed 15% of the area in any of the treatment units.

Table 3-58. Past vegetation treatments in the South Shore project area

Project Name	Dates of Operation	Logging System	Overlap with South Shore project
Pioneer hazard reduction project	1997-2003	CTL and over snow	no
		Hand thin, pile, and burn	yes
Angora hazard reduction	1995-1999	Over snow	no
		Hand thin, pile, and burn	yes
Tahoe Mountain timber sale	1994-1996	Tractor skid	yes - approx. 400 acres
		CTL and over snow	no
Spring Creek summer home tract, Camp Shelly hazard reduction project	1993-1995	CTL and over snow	yes - approx. 400 acres
Cathedral fuel reduction and aspen habitat enhancement project	2004 -2006	Hand thin, pile, and burn	yes
Cathedral burn	1998	Prescribed burn	yes

The primary impact from recreational activities is user created trails. In treatment units in which more than 10% of the area is impacted by unauthorized trails that are not a part of the permanent transportation system, it is possible that cumulative impacts to soils could exceed 15% of the area in some of the treatment units. The Trails Access and Travel Management project scheduled to begin implementation in 2010 would decommission 2 miles of unauthorized trails and implement BMP upgrades on 15 miles of trail in the Taylor Creek, Tallac Creek and Camp Richardson areas, removing potential erosion sources and restoring porosity to the decommissioned trails. Thus cumulative effects from unauthorized recreational use would be reduced in the foreseeable future.

Cumulative effects to soils would be greater under Alternative 2 than Alternative 3. Both action alternatives would produce greater cumulative effects on soils than the No Action alternative without wildfire. Impacts from roads and mechanical treatments would be greater under Alternative 2 than Alternative 3. Impacts from hand treatments would be greater under Alternative 3 than Alternative 2. Overall, impacts to the soil resource would be greater under Alternative 2 than Alternative 3. With implementation of the design features and BMPs, neither Alternative 2 nor Alternative 3 would result in significant impacts to the soil resource.

Irretrievable and Irreversible Commitments of Resources

Neither Alternative 2 nor Alternative 3 would result in irreversible or irretrievable commitments of the soil resource.

D. Water and Riparian Resources

Scope of the Analysis, Issues, and Indicators

United States Geologic Survey (USGS) designated hydrologic unit code (HUC) watersheds based on their relative size from 1 being major river systems to 12 being very small subwatersheds of only a few acres. Watersheds at the 7th field level (i.e. HUC7) are a standard designation of watershed boundaries between approximately 3,000 and 10,000 acres. The HUC7 watershed size is commonly used for project effects analysis because this watershed size has been shown to be small enough so that effects are not disproportionately diluted and yet large enough so that effects are not unrealistically magnified or segmented and missed entirely. The project boundary for the South Shore project includes portions of 21 HUC7 watersheds, 18 of which are included for the South Shore project analysis (Map 15.) The majority of the upper watersheds in the South Shore analysis area are publicly owned, although there is a substantial amount of private land in the lower watersheds nearer the Lake. Most of the private lands are developed into residential communities, commercial areas, and roadways. Two of the HUC7 watersheds in the project boundary do not have any proposed treatments in them, and therefore were not included in the effects analysis for the South Shore project. These include: Heavenly Valley Creek and headwaters of the Upper Truckee River. In addition, one of the proposed South Shore treatment units extends slightly beyond Lake Tahoe Basin watershed boundaries into the Headwaters South Fork American River watershed, which does not drain into the Lake Tahoe Basin. The Forest boundary is not concurrent with the watershed boundary in this area, but these lands are managed by the LTBMU. Because this small area does not drain into the Lake Tahoe Basin, it was also not included in the South Shore effects analysis. Therefore, there are 18 HUC7 watersheds where project activities would occur, and which drain into Lake Tahoe, included in the effects analysis for the South Shore project.

Water quality and watershed condition are major concerns to the public and state agencies in the Lake Tahoe Basin. Concerns about effects to watershed condition and water quality were two of the public issues for the South Shore project that were important in the development of Alternative 3, as discussed in Chapters 1 and 2.

Existing Conditions

The South Shore project area is located on the south end of the Lake Tahoe Basin in the eastern Sierra Nevada mountain range. Elevations in the project area range from 6,224 ft at lake level to approximately 8,000 ft near Luther Pass. Average annual precipitation ranges from approximately 20-60 inches depending largely on elevation, and occurs mostly in the form of snow. Rain-on-snow events are infrequent, but can dramatically affect the landscape and stream channels within the project area and often contribute disproportionate amounts of pollutants to surface waters and to Lake Tahoe. However, because most of the precipitation in this area is snow, spring snowmelt contributes the majority of the stream flow throughout the year.

Within the South Shore project area there are 6,255 acres of RCAs (Map 14) containing 732 acres of SEZ (Map 15). RCAs are a buffer for streams, special aquatic features and other hydrological depressions defined by the Sierra Nevada Forest Plan Amendment (SNFPA) (USDA FS 2004). The buffer width is dependent on the stream or feature type (perennial, intermittent, ephemeral) rather than soils or vegetation present in the area. There are fewer acres of SEZs than of RCAs, as shown in Table 3-64 below. SEZs are defined by TRPA and the Lahontan Water Board as biological communities that owe their characteristics to the presence of surface water or a seasonally high groundwater table. The criterion for defining SEZs includes indicators of vegetation, hydrology, and/or soil type (State of CA 1995). For South Shore project planning purposes, SEZ acres were determined based on the occurrence of 1B soil types taken from the NRCS 2007 soil survey (USDA NRCS 2007). In addition, riparian vegetation was mapped by the USFS on infrared, low-altitude aerial photographs taken in 1987. Map 15 displays the SEZ areas in the South Shore analysis area based both on 1B soils and on the riparian vegetation layer for comparison and to illustrate areas of overlap. Because both of these methods for determining SEZ locations and extent have inaccuracies that may over- or under-estimate actual SEZ acres, the SEZ designations for South Shore project implementation would be made based on field verification of SEZ indicators on the landscape.

Table 3-59. Treatment Acreage for HUC7 Watersheds in the South Shore project Area

HUC7 Watershed Name		Alternative 2			Alternative 3		
	Drainage Area (Acres)	Hand Trtmt Acres	Mech Trtmt Acres	Total Trtmt Acres	Hand Trtmt Acres	Mech Trtmt Acres	Total Trtmt Acres
Angora Creek	3693.6	448	217	665	571	71	642
Benwood Meadow	3682.8	146	1	147	84	3	86
Big Meadow Creek	3271	210	171	382	275	107	382
Bijou Frontage	3763.3	239	16	256	239	16	256
Camp Richardson Frontal	2658	167	540	707	196	511	707
Cascade Creek	3019.1	1	0	1	1	0	1
Cold Creek	8172.9	2	48	50	2	49	52
Echo Creek	3459.7	126	116	242	211	25	235
Glen Alpine Creek	6935.7	91	0	91	91	0	91
Grass Lake	4032.6	417	222	639	512	127	639
Headwaters of Trout Creek	7500.2	255	605	860	431	394	824
Lower Trout Creek	3538.4	6	840	846	6	583	589
Lower Upper Truckee River	4292.4	489	171	660	515	145	660
Middle Upper Truckee River	4033.6	748	336	1083	787	293	1081
Osgood Swamp	3145.6	212	399	611	259	277	535
Saxon Creek	5397.2	588	413	1001	549	384	933
Tallac Creek	2790.1	321	491	812	494	308	802
Taylor Creek	4985.1	484	1080	1564	740	802	1542

Currently, both RCAs and SEZs have fuel loads that exceed the SNFPA desired conditions for WUI areas. Two reasons for the high fuel loading are: 1.) the history of fire suppression in this area and 2.) lodgepole pine and other conifer species encroaching in meadows, aspen stands, and riparian areas. Another factor contributing to excessive fuel loads is that in the recent past SEZ areas within other fuel treatment projects have not been adequately treated for fuels reduction, due to strict limitations for ground-based equipment operations in SEZs. Therefore, the primary treatment in SEZs in recent years has been carried out by hand crews, treating trees only up to about 14 inches in diameter. In many cases, hand thinning has not successfully met fuel reduction goals because of the substantial amount of standing and dead material present greater than 14" diameter. Therefore, fuel loads after hand thinning treatments often remain high, and continue to represent hazardous conditions. The result is that SEZs in the project area that have not been treated in recent years, and many of those that have only been hand thinned have been identified as a wildfire hazard near residential communities.

The TRPA revised their Code of Ordinances in December 2004, in response to the Lahontan Water Board updating their Basin plan in 1995, to allow for the use of "innovative technology equipment" for vegetation management treatments in SEZs (State of CA WQCP 2005, TRPA 2004). The first projects to apply this new guidance have been completed and include the LTBMU Heavenly Valley Creek SEZ demonstration (HSEZ) project (Norman et al. 2008) and the Celio Ranch project (Goldberg 2006). The HSEZ fuel reduction project was implemented in late summer of 2007. The project utilized low ground pressure (i.e. 6 psi alone or 13 psi fully loaded) mechanical equipment (CTL harvester and forwarder) to treat heavy fuel loads in the SEZ, and included an intensive monitoring program to evaluate the soil and water resource effects of the project. The results of that study demonstrated that the CTL mechanical operations resulted in a minor decrease in saturated hydraulic conductivity (Ksat, a measure of soil infiltration capacity) (Norman et al. 2008). However, the established threshold for Ksat was not reached, and the difference between pre- and post-project values did not result in ecologically significant impacts to soil hydrologic function such as infiltration, permeability, and runoff (Norman et al. 2008). In addition, there was no statistically significant difference between pre- and post-project soil bulk density. The 11% reduction in soil cover measured was well within the range of acceptable soil cover set forth in the USFS Region 5 soil quality standards (USDA FS 2004). Additional details about the results from the HSEZ monitoring effort are available in the Hydrology specialist report (located in the project file). The HSEZ project monitoring results showed that mechanical treatment of SEZs with CTL forwarding and harvesting technology could be safely implemented under favorable soil moisture conditions (i.e. relatively high Ksat and low soil moisture content) without causing ecologically adverse impacts to soil or water quality (Norman et al. 2008).

Direct and Indirect Environmental Consequences by Indicator

Alternatives 2 and 3 are distinct from one another in many ways; however they do have several similarities. Throughout this section, the effects from Alternatives 2 and 3 are analyzed together so that comparisons can be easily made and redundant text eliminated. Differences between the two action alternatives are identified for each of the indicators below.

Indicators of both the current conditions and activity effects to water and riparian resources are complex, and will be discussed individually. A discussion of general conditions that influence all of these more specific indicators was given above. The purpose of this structure for water and riparian resources is to provide readability and clarity for comparison among alternatives. The specific indicators for water and riparian resources are linked to aquatic management strategy (AMS) goals (USDA FS 2004 SNFPA), and include: watershed condition; stream channel condition; water quality; beneficial uses; and floodplains, wetlands, and aspen stands. Cumulative watershed effects will be discussed last.

Watershed Condition

AMS goal – Watershed Condition: Maintain and restore soils with favorable infiltration characteristics and diverse vegetative cover to absorb and filter precipitation and to sustain favorable conditions of stream flows.

AMS goal – Watershed Connectivity: Maintain and restore spatial and temporal connectivity for aquatic and riparian species within and between watersheds to provide physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.

Erosion and sedimentation in the south shore increased with the onset of urbanization, and increases in human population density led to increases in nutrients carried by surface water to Lake Tahoe (USDA FS LTBMU 2004). The rates of loading for finer particulates from hillslopes are currently higher than in the past, due to the connection of hillslope roads and trails to surface waters. The dominant erosional process identified within the south shore is surface erosion. Trout Creek and the watersheds in the eastern portion of the analysis area have greater surface erosion potential than other drainages, likely because of a greater potential to deliver sediment from the thicker layer of soil parent material.

Fire suppression and conifer encroachment have been identified as the main cause of overly dense upslope forest areas which can alter water flows and soil moisture conditions. Dense forest stands can remove more water in the upper watersheds, reducing the amount of water held in the soil profile and available to downstream areas. Without control by frequent fire, vegetation establishment and growth following Comstock-era logging has reduced forest structural diversity and increased the proportion of conifer vegetation types in riparian areas and aspen stands (USDA FS LTBMU 2004).

The South Shore analysis area has been well studied in recent years due to the large number of channel and watershed restoration projects, erosion control projects, and vegetation management projects that have been implemented. In general, the upper portions of the watersheds in the South Shore analysis area consist of steeply sloping mountains that are primarily National Forest lands. The lower portions of these watersheds are relatively flat and more urbanized, with a mixture of private and public lands. Several channel and watershed restoration projects have already been completed in the area, and others are in various stages of the planning process. Completed projects have resulted in improved functionality of channel floodplains, attenuated peak flows (i.e. reduced peaks with greater spatial distribution), increased sediment deposition, and decreased bank erosion as water is transported through restored channel reaches.

Local jurisdictions, including El Dorado County and the City of South Lake Tahoe, state and federal agencies such as the California Tahoe Conservancy (CTC) and the LTBMU have been rigorously addressing urban runoff problems throughout the south shore region in recent years. Urban erosion control projects have been completed and are currently being planned in the South Shore analysis area. These erosion control projects serve multiple benefits for urban water quality including sediment source control and storm water treatment for nutrients and sediment. Many of the impacts from impervious coverage in urban areas in the South Shore analysis area have been offset to some degree due to the amount of existing erosion control infrastructure.

In 2007 the South Lake Tahoe community experienced a severe wildfire in the Angora Creek watershed. Field observations and aerial photography of the Angora Fire show a range of fire intensities and effects. In lightly and moderately burned areas, the fire resulted in short-term detrimental effects including temporary loss of ground cover (soon replaced by needle fall), and mortality of the majority of the conifer trees. In areas with high intensity burns, effects were more detrimental in that ground cover was completely removed and nearly all vegetation was killed. Stream shade was almost entirely lost in some areas, and large and small organic material was eliminated. The effects of the Angora Fire on several riparian zones within the burn area demonstrate that increasing forest resiliency to wildfire would better meet Forest plan riparian conservation objectives (RCOs) for the long-term.

Direct and Indirect Effects to Watershed Condition

Alternative 1

With the No Action alternative, the watershed conditions in the South Shore project area would not be changed. Riparian areas and SEZs in project locations would continue to exhibit degraded conditions with the No Action alternative due to competition for water and nutrient resources from encroaching conifer vegetation.

In addition, forested areas in each of these watersheds would remain in an overly dense condition with high fuel loads, and would continue to pose a wildfire threat to surrounding communities, possibly leading to destruction of life and property. Similar results as occurred in the Angora Fire area would be expected if a wildfire burned through the South Shore project area riparian areas and RCAs under the No Action Alternative. The existing stand conditions were applied to a fire simulation model (Flammap) to predict wildfire behavior in the South Shore project area. The results of Flammap simulations indicate that a large proportion of the South Shore could be at risk of a high severity wildfire under Alternative 1, as described previously in the Fire and Fuels section of this Chapter.

Alternatives 2 and 3

In contrast, the Flammap model simulations for the expected conditions after proposed treatments in both Alternatives 2 and 3 projected that both Alternatives 2 and 3 would significantly reduce the threat of high severity wildfire in comparison with the No Action alternative. Therefore, both proposed action alternatives would result in long-term benefit to the watershed conditions in the South Shore analysis area by reducing the potential for negative watershed effects from a large scale, high intensity wildfire.

Stream Channel Condition

AMS goal – Watershed Connectivity: Maintain and restore spatial and temporal connectivity for aquatic and riparian species within and between watersheds to provide physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.

In general, erosion rates from alluvial lands are higher in the South Shore area than they were historically, due to chronic, widespread, slow stream bank and bed erosion caused by degraded stream conditions (USDA FS LTBMU 2004). The degraded stream conditions further facilitate encroaching conifer vegetation and the loss of woody riparian species such as willow and alders along stream channels. Many channel reaches are vertically and/or laterally unstable (WRA 2000, Tahoe Resource Conservation Dist. 2003, Swanson 2006, County of Eldorado 2003, Swanson 2007, and Stantec 2006). Stream channel segments are often characterized by unprotected banks that have little resistance to erosion provided by bedrock and boulders, rooted woody or herbaceous vegetation, or embedded large woody debris. In some cases these banks are actively eroding.

Stream channel conditions will be discussed in the following groups to provide a clear, site-specific discussion of the highly variable conditions in the South Shore project area:

The Upper Truckee River HUC 5 watershed covers a majority of the South Shore project area, and includes the following HUC7 watersheds: Headwaters of the Upper Truckee, Middle Upper Truckee, Lower Upper Truckee, Benwood Meadow, Big Meadow Creek, Grass Lake, Saxon Creek, Osgood Swamp, Angora Creek, Headwaters of Trout Creek, Lower Trout Creek, and Cold Creek.

The Taylor, Tallac, and Spring Creek area includes the Taylor Creek, Tallac Creek, Glen Alpine Creek, Cascade Creek, and Camp Richardson Frontal HUC7 watersheds. The Glen Alpine Creek and Cascade Creek watersheds are primarily undeveloped and the stream channels within these watersheds are in relatively good condition. The Camp Richardson Frontal watershed, while it is mostly developed, does not contain any large channels. Therefore, these three watersheds are not discussed in detail in this section on stream channel condition.

The Upper Truckee River watershed is the largest watershed within the South Shore project area, draining approximately 56.5 square miles. Several of the channels within the Upper Truckee River watershed have been modified from their natural conditions by human activities, including: residential, commercial, and industrial development; roads; golf courses; railroad grades; livestock grazing; irrigation and ditching in floodplains; an airport; constructed berms along channel edges; and historic logging. In addition, natural sediment transport and channel hydrologic processes have been affected by placement of fill in the floodplain/meadow areas and construction of other structures such as bridges, culverts, and pipelines (i.e. sewer and water) that can affect hydrologic function. Effects of these historic land use impacts are multiple. Channel straightening and deepening has decreased the occurrence of over bank flows and decreased the seasonal elevation of shallow groundwater in the surrounding meadows. Other effects are channel relocation; denuded meadows and stream banks; and increased runoff and sediment transport. The floodplains along these channel sections no longer function properly, and incised channel segments themselves act as a continued source of sediment, impacting water quality in downstream reaches (WRA 2000, Tahoe Resource Conservation Dist. 2003, Swanson 2006, EDOT 2003, Swanson 2007, and Stantec 2006). The majority of channel degradation has occurred in the lower portions of the channels, where urban development in the WUI has more influence.

While these impacts have resulted in degraded channel conditions in some locations, there are also portions of each of the stream channels in the Upper Truckee River watershed that are functional and stable. The upper (headwater) sections of streams have been largely unaltered, and provide valuable water storage and habitat functions.

A number of restoration projects have been completed in the recent past within the Upper Truckee River watershed and will be discussed below in past, present, and reasonably foreseeable activities for cumulative effects. The completed channel and SEZ restoration projects have improved the functionality of floodplains adjacent to the channels, increased the potential for water quality improvements as water passes through restored reaches, and resulted in attenuated peak flood flows.

In the Taylor, Tallac, and Spring Creek area, Taylor Creek is the largest of the HUC7 watersheds in this portion of the South Shore project area. Taylor Creek, at its outfall to Lake Tahoe, drains approximately 18.4 square miles, including the area draining into Fallen Leaf Lake. Tallac Creek drains approximately 4.6 square miles, with its tributary Spring Creek draining approximately 0.8 square miles. Taylor and Tallac are both steep, confined creeks upstream of their respective Highway 89 crossings. Just downstream of the highway both creeks show a pronounced break in slope separating the upper erosion and transport zones from the lower depositional fans or deltas. Reasons for accelerated “unnatural” channel incision are not evident in these watersheds, however, there is evidence of unnatural aggradation (sediment accumulation). Because of their steep upper watersheds, the headwaters of both Taylor and Tallac Creeks have relatively high natural erosion rates compared to other parts of the Tahoe Basin. They are expected to continue to generate large volumes of sediment during episodic disturbances (e.g., landslides and debris flows during especially wet years). Fallen Leaf Lake traps most of the sediment from the upper portion of the Taylor Creek watershed, whereas the headwaters of Tallac and Spring Creeks are able to transport sediment all the way to the Baldwin Beach wetland area adjacent to Lake Tahoe. Most of the sediment in Taylor Creek downstream of Fallen Leaf Lake appears to come from erosion on outside bends of the stream channel, combined with fine sediment from trails and footpaths adjacent to the creek. In Tallac and Spring Creek, most of the coarse sediment appears to come from debris flows and channel erosion in the headwaters, and most of the fine sediment appears to come from horse grazing and bank trampling in the wetland area of Tallac Creek (EDAW and PWA 2005).

In summary, historic land use practices are the primary cause of stream disturbance and the resulting instability in the South Shore project analysis area watersheds. These past land use activities have degraded channel conditions and likely increased sediment concentrations in surface waters. Currently, some segments of the stream channels in the South Shore analysis area are stable and/or recovery is occurring from past disturbances. In addition,, ongoing channel restoration efforts are continuing to improve stream conditions.

Direct and Indirect Effects to Stream Channel Conditions

Alternative 1

Stream channels in the South Shore analysis area exhibit a variety of conditions. While portions of stream channels in the project area exhibit good functional conditions, portions of these channels are also degraded, and would remain degraded under Alternative 1. The current condition of south shore channels will not change under the No Action alternative, with the exception of proposed restoration activities not related to the South Shore project.

Alternative 2 and Alternative 3

Chapter 2 details design features to be used in order to avoid possible direct effects to surface waters where mechanical equipment operations would occur in close proximity to stream channels along perennial or intermittent streams and lakes. The purpose of these design features is to protect channel bank stability, to maintain channel shading, and to provide large woody debris at desired levels. Chapter 2 also details the SEZ sensitivity analysis and the criteria that would apply to both action alternatives to avoid direct and indirect effects to water and riparian resources.

Temporary stream crossings for South Shore project implementation include 28 temporary crossings on ephemeral channels, and one temporary crossing on an intermittent channel. The number of stream crossings and the type of channel that would be crossed are given for each HUC7 watershed below:

Angora Creek	– 2 ephemeral crossings
Camp Richardson Frontal	– 1 ephemeral crossing
Grass Lake	– 2 ephemeral crossings
Headwaters of Trout Creek	– 1 ephemeral crossing
Lower Trout Creek	– 1 ephemeral crossing
Lower Upper Truckee River	– 3 ephemeral crossings
Middle Upper Truckee River	– 1 ephemeral crossing
Osgood Swamp	– 3 ephemeral crossings
Saxon Creek	– 1 intermittent and 1 ephemeral crossing
Tallac Creek	– 4 ephemeral crossings
Taylor Creek	– 9 ephemeral crossings

Culverts and stream crossings would be installed to permit water flow and fish passage. Installation and removal of the temporary crossings may result in soil displacement and loosening which could lead to a short-term increase in sediment delivery to downstream reaches. However, because all of the temporary crossings on ephemeral drainages will be constructed and removed when the channels are dry, negative effects are not expected from these temporary stream crossings.

Implementation of either action alternative of the South Shore project would require replacement of an existing intermittent stream crossing on a tributary to Saxon Creek located in the Lower Trout Creek HUC7 watershed on Forest Service system road 12N01A. The existing low water crossing on this intermittent channel is acting as a flood passage barrier, causing erosion immediately downstream, and aggradation upstream. The new channel crossing would be designed to accommodate a 100 year flood event. The crossing would be constructed in the fall, during drier channel and meadow conditions which would reduce direct impacts to this tributary or to Saxon Creek. Replacing this crossing would substantially improve the conditions in this intermittent channel, and better connect the upstream and downstream portions of the channel and meadow. The removed fill would no longer restrict flood flows across/through the road. Because the channel and meadow would be relatively dry during installation, dewatering and diversions are not expected to be necessary. If groundwater is intercepted during construction, impacts would be minimized by pumping this groundwater to adjacent upland areas. Although short-term impacts are possible from removing fill in the floodplain, and the potential for construction impacts exists, the long-term result of replacing this stream crossing will be beneficial to the stream and the associated floodplain.

In the Osgood Swamp HUC7 watershed there is a culvert in the project area along system road 12N20 that has been crushed. This culvert is no longer passing the flow of the channel and is acting as a fish passage barrier. In addition, this crossing is too narrow for ground based equipment access without the potential for resource damage to occur. Prior to using this stream crossing for either action alternative of the South Shore project, the stream crossing would be replaced. Because this channel is spring fed, it flows perennially and would need to be dewatered and the flow diverted around the site during culvert replacement. Environmental effects would be minimized by pumping any remaining water in the culvert replacement area and/or intercepted ground water to nearby upland areas. Prior to allowing the channel flow back into the downstream reach after crossing installation, effects to water quality would be prevented by pumping water to upland areas until water quality is acceptable for discharge into the channel.

At this time, these are the only fish passage and/or water and sediment conveyance barriers that have been identified in the treatment area. Upgrading these crossings will improve watershed connectivity in these areas and will reduce the delivery of sediment and pollutants from the existing degraded crossings to downstream areas and Lake Tahoe. While short-term negative effects from fill removal and construction are possible, because the South Shore project would improve the condition of these channel crossings, a reduction of erosion and sediment delivery in these channels is expected for the long-term.

One temporary crossing on an intermittent channel in Saxon Creek watershed would need to stay in the channel over winter. Design features and BMPs would protect the stream channel and surface water quality from being degraded by installation and removal of the crossing. Therefore, no long-term negative effects from this temporary stream crossing are expected (see the Transportation section in this chapter and Chapter 2 for further details.).

While short-term effects to channel segments immediately downstream of proposed channel crossings are possible during the installation and removal of the crossings, these effects should be localized and minimal due to the prescribed design features and BMPs (i.e. timing proposed crossing installation and removal in dry channel conditions). The long-term positive effects of improving two permanent stream crossings would improve stream channel conditions in these watersheds. In addition, the proposed South Shore project activities would help restore groundwater table elevations in some riparian areas and may improve the condition of riparian channel corridors by reducing the density of encroaching conifer vegetation. This project will not otherwise affect existing channel conditions. Implementation of the proposed design features (Chapter 2) and BMPs (Appendix C) would eliminate or mitigate the potential for long-term effects of South Shore project activities on stream channel conditions. Therefore, no long-term negative effects to stream channels are expected with the proposed treatments for Alternatives 2 or 3.

Water Quality

AMS goal – Water Quality: Maintain and restore water quality to meet goals of the Clean Water Act and Safe Drinking Water Act, providing water that is fishable, swimmable, and suitable for drinking after normal treatment.

Lake Tahoe's water clarity is declining because of nutrient and sediment contributions to the Lake from tributary streams and adjacent urban areas. A total maximum daily load (TMDL) is currently under development for Lake Tahoe which has identified various pollutant sources and their importance for the Lake's clarity. The sources identified include: urban development, dirt roads, particulates in the air from road sanding in the winter, and stream bank erosion. Forest Service lands have not been identified as a large contributing pollutant source per acre thus far in the TMDL development process. Although approximately 80% of the Lake Tahoe Basin is "forested upland", most forest soils are in a state of relatively high hydrologic function (Draft Lake Tahoe TMDL PRO Report, 2007).

Because of the prized clarity of Lake Tahoe and the environmental resources available, several stringent water quality limitations have been identified for the Lake Tahoe Basin by Lahontan Water Board and TRPA. The discharge limitations to surface waters presented in Table 3-60 below are identified in either one or both of the Lahontan Basin Plan and the TRPA Code of Ordinances. These discharge limitations apply to water discharges entering any surface water feature in the Lake Tahoe Basin, and therefore apply to the South Shore project activities and other management actions.

Table 3-60. Surface water discharge limitations

Constituent	Maximum Concentration
Total Nitrogen as N	0.5 mg/L
Total Phosphate as P	0.1 mg/L
Total Iron	0.5 mg/L
Turbidity	20 NTU*
Grease and oil	2.0 mg/L
Suspended Sediment	250 mg/L**

* From Lahontan Basin Plan only
** From TRPA Code of Ordinances only

Existing and ongoing water quality monitoring information can be obtained from the United States Geologic Survey (USGS), who maintains stream gages at several locations within the South Shore analysis area. The USGS monitoring sites in the analysis area are located on the Upper Truckee River near Highway 50 at Meyers and in South Lake Tahoe, and on Trout Creek at USFS Rd 12N01 near Meyers, at Pioneer Trail near South Lake Tahoe, and near Tahoe Valley. Continuous stream flow data is collected at these sites, and periodic water quality samples (~25-30 samples) are also collected each year. The water quality data collected by the USGS at these stations will be monitored periodically throughout project implementation to attempt to track South Shore project effects on stream water quality. No additional water quality sampling is proposed with this project.

Based on the 2006 Clean Water Act Section 303(d) List of impaired waterbodies, there are two waterbodies within the South Shore project area, Heavenly Valley Creek and Lake Tahoe, that are listed as impaired for sediment/siltation. In addition, these and several other Tahoe Basin waterbodies within the project area are listed for nutrients (nitrogen and phosphorus), metals (iron), chloride, and/or pathogens. Concentrations of nitrogen, metals, chloride, and pathogens are not expected to be negatively affected by the South Shore project and are therefore not discussed in this section. However, sediment/siltation concentrations in surface waters may be affected by South Shore project activities. Therefore, the waterbodies listed for sediment/siltation have the greatest potential to be affected by the South Shore project.

Because phosphorus can bind to sediment particles and be transported with them, phosphorus (P) concentrations may also be affected by sediment delivery increases associated with this project. However, most of the soils in the South Shore project area are granitic, and characterized by coarse particle sizes. These larger particle sizes exhibit lower surface area, which typically contain lower concentrations of bound P than finer grained soils. In addition, only about 6-40% of the phosphorus bound by suspended sediments in tributaries to Lake Tahoe is biologically available for phytoplankton (USDA FS 2000), and therefore of concern to Lake Tahoe water clarity. Thus, the effects of the South Shore project on water quality as it relates to phosphorus concentrations are expected to be minimal.

In addition, forest floor organic material (litter) has accumulated significantly in forested areas in this region in the absence of frequent fire. This has been more dramatic in the Lake Tahoe Basin than other parts of the Sierra Nevada because of the relatively dry weather characteristic of this area, and the resulting slow decomposition rates of organic material. The existing thick organic horizons on Tahoe Basin soils are contributing nutrients to forest runoff and may act as a nutrient source to nearby surface waters, possibly contributing to the decline in the clarity of Lake Tahoe (Miller et al. 2006, Loupe et al. 2007).

Direct and Indirect Effects to Water Quality

Alternative 1

In the absence of wildfire, the No Action alternative will not affect current water quality conditions. However, given the greater likelihood that a high intensity wildfire will occur in south shore if fuel loads are not reduced in the area, there is a greater potential for water quality degradation with the No Action alternative than with either action alternative. Wildfires have been shown to result in increased runoff, which then may increase the load of dissolved substances to nearby surface waters (USDI 2004). Furthermore, nutrient mobilization after wildfires from smoke and ash can also contribute to water quality degradation.

The No Action alternative will not change the rate of accumulation of organic forest floor material, nor will it reduce the contribution of nutrients to forest runoff from this source.

Alternatives 2 and 3

The primary potential for effects to water quality from South Shore project treatments results from increased erosion potential caused by soil disturbance and compaction from mechanical equipment operations. However, South Shore thinning activities are not expected to measurably increase delivery of sediment to stream channels because of the limited disturbance extent and the prescribed buffers between proposed treatments and stream channels. For additional information about the effects of proposed treatments on soil conditions, refer to the Soils Resources section of this chapter.

In 2006, the LTBMU completed a fuel reduction project in the Ward Creek watershed on the west shore of Lake Tahoe and carried out an intensive soil monitoring effort to evaluate the impacts of the project on soil and water quality. The Ward monitoring units were treated with CTL operations using a forwarder, harvester, masticator, and chipper. The results of the soil monitoring indicated a small reduction in soil cover, however the final soil cover was well above the regional soil quality standards (USDA FS 2004). The results also indicated a reduction in median saturated hydraulic conductivity of 20%, which was not found to be statistically significant, and a 2.5% reduction in bulk density (Christensen and Norman 2007), still well below the 10% threshold for regional soil quality standards. Most of the soils in the Ward project area are finer grained than those in the South Shore project area, and are therefore more susceptible to compaction and displacement. Therefore, the impacts of similar CTL treatments in the South Shore project area are expected to result in lesser impacts than those experienced in the Ward project. Based on these findings, proposed South Shore CTL operations are not expected to result in impacts to soil or water quality, or to erosion potential.

Whole-tree (WT) treatment operations have not been monitored for soil and water quality impacts in the Lake Tahoe Basin, and therefore present an uncertainty about potential impacts. Therefore, soil disturbance, increased erosion potential, and slightly altered hydrology may occur in WT treatment units. Whole-tree thinning operations require the creation of skid trails and larger landings, which makes these treatment units more prone to exposed soil areas and soil displacement. However, skid trail and landing rehabilitation measures have been developed to prevent or mitigate potential long-term effects of this disturbance (Chapter 2). In addition, all tree removal activities include project design features and Forest Service BMPs (USDA FS 2000) to reduce the risk of on-site erosion, and a monitoring plan is included for this project to ensure that prescribed BMPs and design features are properly installed and functioning (refer to Chapter 4).

As mentioned above, two waterbodies within the South Shore project area are listed in the Clean Water Act Section 303(d) as being impaired for sediment/siltation, Heavenly Valley Creek and Lake Tahoe. However, the Heavenly Valley Creek watershed does not contain any proposed South Shore treatments in either Alternative 2 or 3, and therefore the South Shore project will not effect existing sediment concentrations in Heavenly Valley Creek.

Overall, sediment delivery resulting from increased erosion is unlikely with this project, except from concentrated use areas such as landings, temporary roads, and skid trails. These areas comprise a very small portion of each treatment stand (<15%, see soils specialist report located in the project file), and an even smaller proportion of each HUC7 watershed. Design features to maintain soil cover in treatment units would reduce erosion potential. Landings and temporary roads would be treated with water bars, post treatment decommissioning, and other erosion control measures to minimize the risk of increased erosion (Chapter 2 and Appendix C). In addition, landings and skid trails will not be permitted within SEZs in this project, and temporary roads will be very limited in SEZs. Therefore, these project activities are not expected to result in sediment delivery to live channels or to affect existing sediment concentrations in surface waters in the project area.

Project activities may influence nutrient concentrations in surface waters; however the long-term effect would be positive, likely resulting in decreased nutrient concentrations in surface runoff. Fuel reduction and thinning activities will likely result in decreased depth of organic material on the forest floor, which has been shown to be a nutrient source to overland flow (runoff) (Miller et al. 2006, Loupe et al. 2007). Even where project activities do not decrease the depth of organic forest floor material directly, they will effectively reduce the new litter accumulation by decreasing the number of small trees. Although some of the mechanical treatments proposed with the South Shore project include chipping or masticating the thinned material and leaving it on site, mechanical harvesting with chipping does not increase inorganic N and P in surface runoff (Loupe et al., in press). Chip and masticated material typically exhibits higher carbon to nitrogen ratios than forest litter, and therefore is more difficult and takes longer to decompose. Therefore, microbes will utilize (i.e. take up) N and P for longer periods of time for decomposition of chipped and masticated material compared to litter, and will take much longer before releasing these nutrients to surface runoff.

Road related erosion is typically the primary source of existing accelerated erosion, particularly at channel crossings. However, the action alternatives would improve the condition of one channel crossing in the project area, resulting in a reduction of sediment delivery in that channel over the long-term. In addition, project design features and BMPs (Appendix C) will mitigate any effects that temporary crossings may otherwise cause. Because of the importance of road related erosion, road density was used in this analysis as an indicator of the level of road impacts in the project watersheds. The Forest Plan has no standards for this indicator of watershed risk, but an upward trend in these attributes would indicate higher levels of risk. The Proposed Action (Alternative 2) would construct 4.8 miles of new temporary roads, and reconstruct 8.8 miles of existing decommissioned roads for use as temporary roads. Alternative 3 would construct 3.3 miles of temporary roads and reconstruct 6.5 miles of existing decommissioned roads for use as temporary roads. As these numbers indicate, Alternative 2 requires more temporary road length than Alternative 3, thereby resulting in greater potential for water quality impacts due to additional sediment sources from temporary roads during and immediately after implementation. With either action alternative, the new temporary roads would be outsloped and constructed to follow the rise and fall of the land to avoid altering the hillslope hydrology. All temporary roads utilized during the project would be decommissioned as described in the project design features (Chapter 2).

The miles of National Forest System (NFS) roads within the South Shore analysis area are more directly linked to project effects than is the total road network for several reasons:

- The majority of NFS roads are unpaved;
- NFS system roads are the only roads that are managed by the LTBMU;
- NFS system roads are influenced by forest management activities;
- Most of the non-system roads in the project analysis area are paved and are not expected to contribute to erosion or sediment delivery.

The total miles of NFS system roads (maintenance levels 1, 2, 3, and 4 only; see Transportation Section for definitions of maintenance levels) are presented in Table 3-61 below, with the resulting road density for each HUC7 watershed. The road densities are compared in Table 3-46 between the No Action alternative, Alternative 2, and Alternative 3. The changes in road density for Alternatives 2 and 3 result from the added length of temporary roads for each alternative. Just under 1/3 of the existing system roads included in this analysis (31.5%) are paved and the remainder are native surface under Alternative 1 (existing conditions). The percentage of roads that are paved in Alternative 2 and 3 are 27.7% and 28.7%, respectively.

Table 3-61. Forest Service roads and road density in the South Shore project area HUC7 watersheds

HUC7 Name	HUC7 Area (mi²)	Miles of existing roads	Total existing road density (mi/mi²)	Alt 2 Proposed temp roads (mi)	Alt 2 Total road density (mi/mi²)	Alt 3 Proposed temp roads (mi)	Alt 3 Total road density (mi/mi²)
Angora Creek	5.77	4.47	0.77	0	0.77	0	0.77
Benwood Meadow	5.75	0.60	0.10	0	0.10	0	0.10
Big Meadow Creek	5.11	0.59	0.11	0.22	0.16	0	0.11
Bijou Frontage	5.88	2.66	0.45	0	0.45	0	0.45
Camp Richardson Frontal	4.15	9.06	2.18	2.44	2.77	2.44	2.77
Cascade Creek	4.72	1.12	0.24	0	0.24	0	0.24
Cold Creek	12.77	5.27	0.41	0	0.41	0	0.41
Echo Creek	5.41	0.84	0.16	0.59	0.27	0	0.16
Glen Alpine Creek	10.84	2.55	0.24	0	0.24	0	0.24
Grass Lake	6.30	1.58	0.25	0.38	0.31	0.16	0.28
Headwaters of Trout Creek	11.72	6.08	0.52	0.89	0.59	0.79	0.59
Lower Trout Creek	5.53	4.82	0.87	3.23	1.46	2.44	1.31
Lower Upper Truckee River	6.71	2.37	0.35	0.31	0.40	0.31	0.40
Middle Upper Truckee River	6.30	5.08	0.81	0.10	0.82	0	0.81
Osgood Swamp	4.91	2.18	0.44	0.30	0.51	0	0.44
Saxon Creek	8.43	4.07	0.48	2.18	0.74	1.48	0.66
Tallac Creek	4.36	4.75	1.09	1.09	1.30	0.51	1.21
Taylor Creek	7.79	12.56	1.62	1.88	1.87	1.67	1.84
Total				13.61		9.81	

*Total road density was calculated using the following equation:
Road density = Total miles of road / Total area (mi^2) of each HUC7 watershed

As shown in Table 3-61, the road densities in each HUC7 watershed are relatively small and are not expected to pose a threat to water quality. The highest road density in the analysis area under all alternatives is in Camp Richardson Frontal watershed, which is also one of the watersheds with the most proposed temporary road length. Two of the reasons why this watershed has a higher existing road density are; 1.) it is highly impacted by urban development, and 2.) it is the smallest watershed in the South Shore analysis area. Even with the greater road density in the Camp Richardson Frontal watershed, only 1 temporary crossing on an ephemeral channel is proposed within this watershed. Most of the watershed is adjacent to urban development with a need for fuels reduction, which supports a need for the greater length of temporary roads proposed for use in this watershed. The road densities in the remaining watersheds are relatively low, all below 2 mi/mi^2.

Road length within RCAs may further indicate the potential for road related erosion and sediment delivery. The roads within RCA boundaries were analyzed to determine the potential for temporary roads to cause water quality impacts where these roads are in close proximity to surface water features. Table 3-62 presents the road length within the RCA boundaries under Alternative 1, and with Alternative 2 and 3 treatments. Although the South Shore project area is mostly within RCAs (approximately 60% of total treatment acres), comparison of Tables 3-61 and 3-62 demonstrate that a substantial amount of the road network is in the upland areas, over 300 feet away from streams and lakes. Furthermore, in the Camp Richardson Frontal watershed discussed above, only about 1/3 of the temporary roads proposed for use in Alternatives 2 and 3 fall within RCA boundaries. Because the majority of the temporary roads in this watershed are in the upland forest area, the potential for erosion and sediment delivery effects are further reduced.

Most of the road density values decreased between Alternative 2 and 3 because of reduced treatment acres. Although there are differences in road densities between Alternative 2 and 3 because of differences in temporary road needs and some shifts in treatment unit boundaries, there are several HUC7 watersheds that maintained the same road density for Alternative 3 as they had for Alternative 2.

Table 3-62. National Forest road miles within RCAs in the South Shore project area

HUC7 Name	Miles of existing roads	Alt 2 Proposed temp roads (mi)	Alt 2 Total road miles (mi)	Alt 3 Proposed temp roads (mi)	Alt 3 Total road miles (mi)
Angora Creek	1.94	0	1.94	0	1.94
Benwood Meadow	0.60	0	0.60	0	0.60
Big Meadow Creek	0.44	0.11	0.55	0	0.44
Bijou Frontage	1.74	0	1.74	0	1.74
Camp Richardson Frontal	5.43	0.86	6.28	0.86	6.28
Cascade Creek	1.01	0	1.01	0	1.01
Cold Creek	4.05	0	4.05	0	4.05
Echo Creek	0.76	0.58	1.34	0	0.76
Glen Alpine Creek	2.62	0	2.62	0	2.62
GrassLake	0.99	0.09	1.08	0	0.99
Headwaters of Trout Creek	3.92	0.45	4.37	0.44	4.36
Lower Trout Creek	2.25	0.62	2.86	0.52	2.76
Lower Upper Truckee River	1.35	0.18	1.53	0.18	1.53
Middle Upper Truckee River	2.28	0.08	2.35	0	2.28
Osgood Swamp	1.63	0.18	1.81	0	1.63
Saxon Creek	1.85	1.22	3.07	1.20	3.05
Tallac Creek	2.98	0.87	3.86	0.40	3.38
Taylor Creek	9.46	1.31	10.78	1.31	10.78
Total		6.55		4.91	

It is important to note that the proposed South Shore treatments are primarily within the WUI, where road needs are much greater than in the general forest due to the high recreational use from forest visitors and residential communities, and the access needs for fire suppression and forest management.

Landings are another potential source of compacted soils and increased erosion potential from vegetation management projects. Approximately 80% of the landings proposed for use in the South Shore project already exist on the landscape; 20% would be newly constructed. Alternative 2 requires more landings than Alternative 3, which contributes additional impacts for Alternative 2. Refer to the Vegetation Management section of this chapter and Chapter 2 for a detailed description of how landing locations were selected for Alternative 2, utilizing existing landings wherever possible. Because much of the South Shore project area is located close to stream channels and lakes, a significant number of the treatment acres, and therefore the landings, fall within RCAs. In response to water quality concerns, Alternative 3 reduces the total number of landings and landings are moved out of RCAs, resulting in a greater reduction in the number of landings within RCAs. A comparison of landings by HUC7 watershed is given in Table 3-63 for the action alternatives. Effects would be reduced under both action alternatives because landings would be decommissioned after operations are complete. Measures to reduce effects from landings would include first applying wood chip or masticated material to a maximum 6-inch depth, then ripping the landing (where soils allow) to approximately a 12-inch depth, and seeding the areas with a native seed mix of grasses, forbs, and shrubs. Selection of landings for decommissioning would be based on their location (inside or outside of RCAs), size, and soil type. Priorities for decommissioning landings to reduce environmental effects would be location within RCAs, and size greater than ¼ acre, as long as the soil type allows.

Table 3-63. Total number of landings for Alternatives 2 and 3 within and outside of RCAs

HUC7 Name	Alternative 2			Alternative 3		
	Outside of RCA	Inside of RCA	Total	Outside of RCA	Inside of RCA	Total
Angora Creek		3	3	1		1
Big Meadow Creek		6	6	2		2
Camp Richardson Frontal	18	8	26	19	7	26
Cold Creek	1		1	1		1
Echo Creek	1	2	3	1		1
Grass Lake	4	3	7	3	1	4
Headwaters of Trout Creek	5	17	22	7	6	13
Headwaters South Fork American River	2	1	3	3		3
Lower Trout Creek	15	12	27	13	7	20
Lower Upper Truckee River	4	3	7	5	1	6
Middle Upper Truckee River	2	12	14	3	4	7
Osgood Swamp	2	13	15	3	9	12
Saxon Creek	4	12	16	6	9	15
Tallac Creek	10	21	31	9	18	27
Taylor Creek	16	22	38	12	18	30
Total	84	135	219	88	80	168

Potential impacts to water quality on Forest Service managed lands from the South Shore project are associated with effects of potential sediment delivery at stream crossings and from roads and landings located near streams. In the short term while roads are being used for hauling, sediment reductions from road upgrades and road crossing improvements are expected to be balanced by increases due to log hauling and road maintenance. Project related road maintenance activities include improving surface drainage at crossings and approaches to crossings, and upgrading the road surface substrate where necessary for proposed treatment operations (see Transportation Section for more details). With the prescribed design features (Chapter 2) and BMPs (Appendix C), and the limitations to placing landings and skid trails in SEZs, the delivery of sediment from treatment units to stream channels in the project area is expected to be minimal and significant long-term impacts to water quality are not anticipated.

Beneficial Uses

Beneficial uses are water uses which are to be designated and maintained. Several beneficial uses have been identified in the Lahontan Basin Plan (State of CA 1995) for the South Lake Tahoe Hydrologic Area. Beneficial uses that apply to the South Shore project analysis area include:

Municipal and domestic supply
Agricultural supply
Ground water recharge
Freshwater replenishment
Navigation

Water contact recreation
Non-contact water recreation
Commercial and sportfishing
Cold freshwater habitat
Wildlife habitat
Preservation of biological habitats of special significance (Lake Tahoe, Osgood Swamp, Grass Lake Wetlands, and Grass Lake only)
Rare, threatened, or endangered species (Heavenly Valley Creek, Meiss Meadows/Wetlands, Meiss Lake, Taylor Creek Meadow Marsh, and Cascade Lake only)
Migration of aquatic organisms
Spawning, reproduction and development (applies to waters that support high quality aquatic habitat necessary for reproduction and early development of fish and wildlife)
Water quality enhancement
Flood peak attenuation/flood water storage

Direct and Indirect Effects to Beneficial Uses

Alternative 1

The No Action alternative will not directly affect beneficial uses within the South Shore project area. However, the indirect effect of no action is that the risk for effects from high intensity wildfire would remain.

Alternative 2 and 3

About half of the 16 beneficial uses identified for surface waters within the South Shore project area have the potential to be affected by project activities. These include: ground water recharge; non-contact water recreation; cold freshwater habitat; wildlife habitat; preservation of biological habitats of special significance; rare, threatened or endangered species; spawning, reproduction and development; water quality enhancement; and flood peak attenuation/flood water storage. All of these beneficial uses are expected to be positively affected over the long-term. Two potential exceptions could be the non-contact water recreation and cold freshwater habitat beneficial uses. For non-contact water recreation, design features for channel crossings, roads and forwarder/skidder trails, and SEZs and buffers will mitigate any potential sediment delivery impacts associated with the South Shore project. Sediment delivery to Lake Tahoe is not expected to result from South Shore project activities, thus preventing negative impacts to non-contact water recreation. For the cold freshwater habitat beneficial use, stringent design features will be applied adjacent to streams to avoid adverse impact to stream temperature and shading. Stream banks will be buffered and large woody debris will not be removed from the channel to avoid removing vegetation that provides bank stabilization or shade. The effects of treatments within RCAs on water temperatures will be closely monitored to avoid adverse impacts to cold freshwater dependent species (for more information refer to Aquatic Wildlife section in this chapter and the Fisheries BE/BA located in the project file).

These beneficial water uses will also be supported by the proposed project activities to reduce the risk of wildland fire, improve the condition of riparian areas, improve watershed conditions, protect water quality, and protect soil productivity. No differences between Alternatives 2 and 3 regarding the potential effects to beneficial uses are expected.

Floodplains, Wetlands and Aspen Stands

AMS goal – Special Habitats: Maintain and restore the distribution and health of biotic communities in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes) to perpetuate their unique functions and biological diversity.

Urbanization of the Lake Tahoe Basin has degraded or eliminated 75% of its marshes, 50% of its meadows, and 35% of its stream zone habitat (USDA FS 2000). Many of the remaining meadow and non-meadow riparian areas currently have encroaching conifers (USDA FS LTBMU 2004). Most of the wet and mesic meadow environments in the South Shore analysis area are impaired to some degree from several causes:

- impervious surface coverage or compaction,
- fill or debris in the natural floodplain or SEZ,
- hydrologic blockages or artificial drainage of the SEZ,
- functional reduction of the floodplain,
- increased flows or runoff, and
- removal or degradation of riparian vegetation (USDA FS LTBMU 2004).

Competition from conifer species for water, nutrients, and sunlight further led to the decline of riparian vegetation conditions and aspen stand health. The higher conifer stand densities that exist in riparian areas contribute to a greater risk of tree mortality due to fluctuations in the water table and increased susceptibility to insect attack. In addition, higher conifer stand densities in riparian areas transpire more water from soil that would otherwise support wetter vegetation types, and has led to a decline in the condition of riparian springs and seeps (USDA FS LTBMU 2004).

Much of the South Shore project area contains or is adjacent to perennial and intermittent channel floodplains. Currently the ground fuels and the standing trees near these channels provide floodplain roughness under high flow conditions. Floodplain roughness features can slow flood waters, thereby dissipating energy and allowing sediment in the water to settle out on the floodplain. During high flows, roughness features on the floodplain can result in a reduction of sediment concentrations in waters downstream. However, because of the presence of, and competition from, coniferous vegetation on floodplains in the South Shore analysis area, natural floodplain roughness features such as riparian vegetation are in decline. Native riparian vegetation can provide floodplain roughness, and provides the added benefit of reducing nutrients in flood waters. Riparian vegetation can absorb and utilize the influx of nitrogen and other nutrients delivered by flood waters, thereby reducing the concentrations of these nutrients passing through to downstream areas and becoming pollutants of concern for clarity in Lake Tahoe.

The South Shore analysis area also includes many aspen stand acres. During the analysis for the LTBMU aspen community restoration project (currently in planning), aspen stands throughout the Lake Tahoe Basin were evaluated for their risk of loss. Risk of loss is an assessment of the probability that an aspen stand may not persist on the landscape, and is determined by stand conditions such as conifer encroachment and aspen regeneration. The risk assessment is based on factors such as the proportion of aspen within the stand, the amount of regeneration occurring, and the occurrence and condition of understory brush and herbaceous vegetation. These evaluations were used to rate aspen stands in the Lake Tahoe Basin as either no risk, low, moderate, high, or highest risk of loss. Using this information and the South Shore treatment locations, any aspen stands that were inside or adjacent to proposed South Shore treatment units and that were rated as moderate, high, or highest for risk of loss were incorporated into the South Shore treatments to remove encroaching conifers. Aspen stands in the South Shore project area currently exhibit the following conditions:

- Average conifer crown closure is less than 25% in approximately 1/3 of the aspen acres;
- Average aspen crown closure is greater than 40% in only about ½ of the aspen acres;
- Aspen crowns comprise more than half of the canopy in about 40% of the aspen acres;
- Aspen crowns overtop conifer crowns in about 40% of the aspen acres;
- Robust aspen regeneration is occurring in about ½ of the stands; and
- Only 1% of the aspen stands show conifer encroachment is not occurring or is minimal.

Finally, there are several bogs and/or fens (Map 18) located within the project area that are considered to be special aquatic features by the LTBMU Forest Plan. The special aquatic feature designation includes springs, seeps, fens and bogs (USDA FS 2004). Grass Lake is a research natural area (RNA) (USDA FS LTBMU 1988) within the analysis area which does not overlap with any proposed treatments for the South Shore project. Several other portions of the project area include special aquatic features. Osgood Swamp is a sensitive bog within the South Shore project area. Surrounding the Osgood Swamp area and within the Angora Creek watershed are several more special aquatic features containing sphagnum moss species. See the Sensitive Plants section of this chapter for more detail.

Direct and Indirect Effects to Floodplains, Wetlands, and Aspen stands

Alternative 1

The current condition of floodplains, wetlands, and aspen stands in the South Shore project area will not improve under Alternative 1. Coniferous vegetation encroaching in riparian and wetland ecosystems would continue to degrade their condition by out-competing wetter vegetation species for water, nutrients, and sunlight. Wetlands and meadows are likely to continue in a drying trend because conifers use much more water than riparian vegetation does, often drawing down the water level and lowering groundwater tables. Conifers would continue to encroach in these areas. Therefore, floodplain and wetland function would not improve. In addition, aspen stands would continue to be at risk for loss, and conditions would likely decline in aspen stands already at risk. The aspen stands that are currently at the highest risk for loss are likely to be lost in the near future with no action to remove encroaching conifer vegetation under Alternative 1.

Alternatives 2 and 3

Prescriptions for South Shore treatments within RCAs, including floodplains, wetlands, and aspen stands, were designed to improve stand conditions and promote the long-term health of riparian vegetation and aspen, or mixed conifer type vegetation, depending on the location. No non-coniferous riparian vegetation would be removed. Management within RCAs would be designed to meet riparian conservation objectives (RCOs) (USDA FS 2004). Refer to the RCO analysis report (located in the project file) for more information regarding how the South Shore project will meet the RCOs.

South Shore proposed treatments (Vegetation Management section) would effectively reduce the likelihood of a high intensity wildfire such as the Angora Fire by reducing fuel loading substantially within RCAs and SEZs. Implementation of South Shore project treatments will meet the fuel loading objectives of the project and improve the condition of riparian areas and SEZs, including floodplains and channel corridors. Standard BMPs (Appendix C) and specific design features (Chapter 2) will be applied to protect the soil resources and surface water features of each site where mechanical operations are proposed within SEZs and RCAs.

The measurement indicators used to evaluate the alternatives for their success in achieving the goal of restoring floodplain and wetland function where encroaching conifers have degraded their function are: 1.) acres of SEZs and RCAs treated resulting in improved ecological and hydrologic function; and 2.) acres of aspen stands restored. These measurement indicators are summarized in Table 3-64 below for both Alternatives 2 and 3.

Table 3-64. Acres of RCA, SEZ (based on 1b soils), and aspen in the proposed treatment stands for Alternative 2 and 3, for each HUC7 watershed

HUC7 Name	Alternative 2			Alternative 3		
	RCA Acres	SEZ Acres	Aspen Acres	RCA Acres	SEZ Acres	Aspen Acres
Angora Creek	381	35	0	377	32	0
Benwood Meadow	119	16	35	66	15	20
Big Meadow Creek	289	10	18	289	10	18
Bijou Frontage	130	10	7	130	10	7
Camp Richardson Frontal	266	107	1	266	107	1
Cascade Creek	0	0	0	0	0	0
Cold Creek	32	7	0	34	7	0
Echo Creek	178	1	7	172	1	7
Glen Alpine Creek	91	2	2	91	2	2
Grass Lake	429	4	19	429	4	19
Headwaters of Trout Creek	528	66	4	517	64	4
Lower Trout Creek	431	128	33	279	121	12
Lower Upper Truckee River	314	18	0	314	18	0
Middle Upper Truckee River	658	66	19	656	66	19
Osgood Swamp	421	24	0	382	24	0
Saxon Creek	736	73	2	688	73	2
Tallac Creek	450	77	24	443	74	24
Taylor Creek	800	89	119	776	66	116
Total	6253	733	290	5907	693	251

Although Alternative 2 has more acres of RCA, SEZ, and aspen stand treatments in general, the effects of Alternatives 2 and 3 are very similar, and would both result in improved conditions in treated areas. The purpose of the reduction of acres treated and the shifting of treatment types between Alternatives 2 and 3 in many of the RCA, SEZ, and aspen areas is to decrease the watershed impacts of the proposed treatments. Although Alternative 2 appears to better achieve the project goals when looking at acres treated for RCAs, SEZs, and aspen, Alternative 3 reduces total impacts to forest resources associated with the proposed treatments.

Due to soil moisture concerns, slopes in the treatment stands over 30%, or lack of access for ground based equipment, many of the SEZ acres proposed for treatment with the South Shore project will be treated by hand crews. Previous hand treatments in SEZ areas have not resulted in detrimental impacts to SEZs. In the past, hand piling and burning of slash piles was not done within SEZs. Because past treatments generally avoided SEZ areas, disposal of SEZ fuels outside of the SEZ area was achievable. The South Shore project includes fuel reduction within SEZs to an extent that transporting fuels outside of the SEZ for burning or disposal would create greater negative impacts from soil disturbance than hand piling and burning these fuels within the SEZs.

Based on research on burning piles within SEZs using existing practices in Forest Service Region 5, with the application of appropriate design features, piling and burning within SEZs can be done without causing substantial negative impacts. Therefore, the South Shore project includes piling of slash and subsequent burning within SEZs. This will allow for additional conifer treatment in these areas, because all thinned material will no longer need to be removed from the SEZ entirely by hand. In addition, allowing piling in SEZs greatly reduces the number of passes that a hand crew will need to make through the SEZ, thereby reducing the extent of soil compaction from this source.

Design features developed for this project are based on the Region 5 examples for piling and burning within SEZs, and are provided in Chapter 2. Piles will not be permitted within a 50-foot buffer on perennial and intermittent channels, and a 10-foot buffer on ephemeral channels, to prevent mobilization and delivery of piled material to surface waters. These design features would protect stream channels and water quality, avoid sterilizing the soil, and limit the spatial extent of piles to protect riparian vegetation species. Prescribed underburning may be substituted for piling and burning in some instances, however the effects of underburning in SEZs are well known and generally minimal.

As detailed in Chapter 2, the USFS developed a SEZ sensitivity rating system to evaluate the suitability of SEZs for mechanical equipment operations (Appendix D) in order to reduce the potential for negative effects in SEZs. Based on the monitoring results from the Heavenly Creek SEZ project (USDA FS LTBMU 2008), CTL operations in SEZs (i.e. in those areas equal to or less sensitive than the Heavenly Creek SEZ project site) proposed with the South Shore project are not anticipated to result in significant effects to soil or water resources. To ensure that resource damage does not occur in these areas, ground based equipment would not operate on soils that are moist or wet (see Appendix D for detailed soil moisture determination protocol) or which exhibit soil strength less than that of the equipment weight. This may limit the time period for treatment of some SEZs to the fall when soil conditions are drier.

Design features for WT treatment units that contain SEZs would prevent or minimize negative effects using several methods. Hand crews would directionally fell trees toward the adjacent upland areas where mechanical equipment would end-line the material for removal. In larger SEZs within WT units, hand crews would be used for treatment of areas that end-lining is not feasible. Because end-lining would not take place within 25 feet of a perennial or intermittent stream channel, negative effects would be minimal. The 50-foot buffer from the edge of perennial or intermittent stream channels and lakes, and 10-foot buffer from the edge of ephemeral channels, for piling and burning will also reduce effects to floodplains.

The proposed treatments in aspen stands may result in a short-term increase in erosion potential due to increases in exposed soil, compacted soils, and from disturbance of the existing ground cover and litter layer. The long-term effects of the aspen stand treatments, however, will result in improved growing conditions for aspen due to increased water availability, increased available sunlight, increased solar penetration to the soil, and soil disturbance (which aspen responds very positively to). Aspen trees are intolerant to shade (USDA FS 2006), and therefore should benefit greatly from removing conifers from the area. Additionally, more sunlight will reach the soil, increasing soil temperatures, and providing the proper growth environment for aspen suckers (USDA FS 2006). The soil disturbance associated with aspen stand treatments will result in a long-term decrease in erosion because of the ground cover provided by the expected establishment of herbaceous understory vegetation. Furthermore, soil disturbance would benefit aspen regeneration by allowing pre-existing buds to produce new suckers that would grow into additional aspen trees (USDA FS 2006). Improved growing conditions will also result in greater soil cover from young aspen regeneration. The expected outcome of proposed South Shore treatments is healthy aspen stands where average conifer crown closure within aspen stands is less than 25% after project treatments, average aspen crown closure increases to greater than 40%, aspen would comprise more than half of the canopy, and aspen would overtop conifer crowns in aspen stands.

Special aquatic features in the project area include two fens near the Angora burn area boundary, Osgood Swamp and several surrounding fens, and the Grass Lake resource natural area. Additional design features to ensure protection of the special aquatic feature, and the surrounding soil and surface hydrology consistent with RCA objectives (USDA FS 2004) are included for treatment stands near these features. Implementation of the design features found in Chapter 2 for special aquatic features is expected to prevent or minimize negative effects to special aquatic features.

The proposed treatments in floodplains, wetlands and aspen stands would result in decreased conifer encroachment and wildfire hazard, and would also enhance riparian vegetation, increase water quality treatment along stream corridors, and improve habitat for riparian dependent wildlife species. In addition, removing conifer vegetation along floodplains and meadows will help restore more natural timing, variability and duration for floodplain inundation. Conifer removal is also expected to raise water table elevations due to a decrease in water uptake and transpiration. Conifer removal would improve the growing conditions in these areas for riparian and wet meadow species, which are more diverse and productive than the conifer species present now. Some of the potential short-term effects of the proposed conifer removal from these areas include reduced floodplain roughness, temporary increases in erosion potential, and slightly altered hydrology (in WT treatments only). However sediment delivery to stream channels and surface water are expected to be minimal because of the limited disturbance extent and the prescribed buffers between treatments and stream channels. Therefore, floodplains, wetlands, and aspen stands may experience short-term negative effects, but are not expected to be negatively affected by this project in the long-term.

Cumulative Impacts

Past, Present, and Reasonably Foreseeable Effects for All Alternatives

The communities in the South Shore project area contain over 30,000 homes serviced by a complex system of roads which can act as a delivery system for eroded and deposited soil to enter streams, rivers, and Lake Tahoe. Obliteration of legacy roads and trails in the Tahoe Basin was identified as having the greatest potential to efficiently reduce sediment loading from forested areas, especially if conducted at the same time as planned forest management treatments (Lake Tahoe TMDL PRO 2007). The recommendation from the TMDL researchers is to maintain current practices employed by the Forest Service for forest management, including standard BMPs, and incorporate decommissioning roads and landings to the extent feasible. The LTBMU recently completed BMP upgrades on roads throughout the Lake Tahoe Basin to reduce the conveyance of road-borne sediments into streams and their associated water quality impacts. The actions taken with the BMP retrofit program included decommissioning or obliterating unnecessary roads, converting selected roads to trails, and upgrading Forest roads with applicable BMPs. In the South Shore analysis area, BMP retrofits were completed on 31 miles of road, 30 miles of roads were decommissioned, and 2.3 miles of road were converted to trails (Briebart et al. 2007).). In addition, BMPEP evaluations for road surface drainage and slope protection, stream crossings, and control of sidecast materials were completed on select roads throughout the Tahoe Basin as part of this study, and all of the BMPEP evaluations completed on the south shore of Lake Tahoe were rated as effective (Briebart et al. 2007). The connected length of road segments (defined as the length of road that is hydrologically connected to a surface water body through rills, gullies, overland flow or drainage ditches) was reduced in the South Shore project analysis area by 0.2 miles. The study indicated that there are no high-risk connected road segments in the south shore area, and low-risk segments decreased from 0.5 to 0.3 miles, while moderate-risk segments remained at 0.6 miles (Briebart et al. 2007).

An additional existing impact to water quality within the South Shore analysis area comes from the effects of the Angora Fire. The boundary of the Angora Fire, which burned through portions of the South Shore project analysis area in June and July of 2007, overlaps five of the HUC7 watersheds within the project area, including: Angora Creek, Camp Richardson Frontal, Lower Upper Truckee, Osgood Swamp, and Taylor Creek. Some of the effects from the fire are increased hydrophobicity of the soils that burned, and decreased ground and canopy cover. At this time, over a year has passed since the Angora Fire, and much of the risk for large scale sediment delivery from the burned area has been greatly reduced. Nonetheless, in the high-intensity burn areas where the seed source is less, the potential for erosion remains accelerated until natural vegetation reoccupies these areas in the next 2-5 years (Weaver et al. 2007). Only one of the five watersheds affected by the Angora fire also appears on the 303(d) list. This is the Lower Upper Truckee River (i.e. below Christmas Valley), which is listed for nutrients and metals only. The Angora wildfire may continue to affect nutrient contributions to nearby surface waters from increased surface erosion and mobilization of surface soil nutrients in ash. South Shore project activities are not expected to increase concentrations of nutrients or metals, and therefore would not create a cumulative effect for nutrients or metals in surface waters.

A number of restoration projects have been completed in the recent past within the Upper Truckee River watershed.

- The Cookhouse Meadow Restoration project completed by the LTBMU in 2005 resulted in channel restoration of 2,200 ft of Big Meadow Creek which decreased fine sediment sources within the channel and decreased the associated water turbidity.
- Several restoration projects have been completed in the Angora Creek watershed, including an El Dorado County restoration project in 2005-2006 involving replacing a low water crossing which previously acted as a fish passage barrier. This project restored 2,300 ft of channel and included 4.5 acres of SEZ enhancement. The CA State Parks also restored Angora Creek through the sewer reach (constructed 2002) and the golf course reach (constructed 1997-98), resulting in a combined restored stream length of approximately 8,000 ft.
- A 6,000 ft reach of the Cold Creek channel in the lower watershed just below Pioneer Trail was restored in 1994-95 by the City of South Lake Tahoe (CSLT) and the CTC.
- In 1999-2001, a reach of Trout Creek below Pioneer Trail was also restored with a CSLT and CTC project, resulting in 10,075 ft of restored channel length, 105 acres of SEZ enhancement, and 25 acres of riparian habitat enhancement.
- The Lower West Side restoration project was completed by the CTC in 2001 near the mouth of the Upper Truckee River at Lake Tahoe. This project removed fill material that had been placed on the floodplain, and restored approximately 12 acres of floodplain and meadow terrace.

The completed channel and SEZ restoration projects have improved the functionality of floodplains adjacent to the stream channels, increased the potential for water quality improvements as water passes through restored reaches, and resulted in attenuated peak flood flows.

Future restoration projects being planned within the South Shore analysis area include:

- Cold Creek, High Meadows channel restoration project expected to restore approximately 18,000 ft of channel (2009-2011) – LTBMU;
- Upper Truckee River, Airport Reach channel restoration began in 2008 and will restore about 4,000 ft of incised channel – CSLT;
- Upper Truckee River, Sunset Reach channel restoration project to restore 12,000 ft of channel (2010-2012) – LTBMU and CTC;
- Upper Truckee River, State Parks Reach channel restoration of 7,920 ft of channel (2012-2014) – CA State Parks;
- Upper Truckee River, Marsh Reach restoration of about 9,000 ft of channel (2012 or after) – CTC;

- Spring Creek culvert replacement planned for 2009. This will improve a crossing that is currently acting as a fish passage and water and sediment conveyance barrier by replacing the existing culvert – LTBMU. Replacing this bridge will eliminate a source of erosion in the Spring Creek watershed, and improve sediment sorting and routing in the Spring Creek channel.
- Taylor and Tallac Creek channel and meadow restoration project, the details and construction timing for this project are still unknown – LTBMU.

These reasonably foreseeable future channel restoration projects will improve floodplain and wetland function, and will increase sediment storage in restored reaches, thereby reducing sediment delivery to Lake Tahoe from stream channel sources. There may be some short-term effects of these channel restoration projects related to construction, however BMPs and project designs will reduce and mitigate these impacts to a non-significant level. In addition, the construction timing for the various projects has been phased to reduce the amount of channel disturbance in any given year.

Cumulative Watershed Effects (CWE)

Analysis Methodology and Existing CWE Conditions

ERA Methodology

Similar to the overall effects analysis for hydrologic resources, the CWE analysis for the South Shore project evaluated watersheds at the HUC7 scale. Beneficial uses of most concern (aquatic communities) are supported at the HUC7 watershed scale, and changes in the mechanism of concern (surface erosion) can be detected. At larger scales, effects may be diluted. A primary assumption of this analysis is that protection of beneficial uses at this scale also results in protection of uses at larger scales, in this case, downstream beneficial uses in Lake Tahoe.

For each HUC7 watershed, a Threshold of Concern (TOC) was calculated using the NRCS 2007 soil survey. The updated soil types in the 2007 survey have an allowable impervious coverage percentage associated with them, based on the Bailey's land capability classification system (Bailey 1974). The Bailey's system defined a threshold value of equivalent impervious surface an area can tolerate before the potential for adverse impacts can be expected. The calculated allowable impervious coverage (IC) is weighted by area within each analysis watershed and summed to give TOC for that watershed. TOC does not represent the exact point at which cumulative watershed effects will occur; rather it serves as a "yellow flag" indicator of increasing susceptibility for adverse cumulative effects. Susceptibility to CWE generally increases from low to high as the level of land disturbing activities increases toward or past TOC. TOC for a watershed can be expressed as a percentage of the watershed area or as total acres. TOC values in the South Shore analysis area are presented in Table 3-65, and range from 3.2% in the Glen Alpine Creek watershed to 17% in Osgood Swamp watershed.

Table 3-65. HUC7 Watersheds, total acreage and threshold of concern values

HUC7 Watershed Name	Drainage Area (Acres)	Allowable Impervious Coverage (IC) Acres	TOC for each watershed
Angora Creek	3693.6	533.3	14.44%
Benwood Meadow	3682.8	286.0	7.77%
Big Meadow Creek	3271.0	193.4	5.91%
Bijou Frontage	3763.3	476.9	12.67%
Camp Richardson Frontal	2658.0	390.1	14.68%
Cascade Creek	3019.1	124.1	4.11%
Cold Creek	8172.9	481.7	5.89%
Echo Creek	3459.7	161.2	4.66%
Glen Alpine Creek	6935.7	221.0	3.19%
Grass Lake	4032.6	259.2	6.43%
Headwaters Trout Creek	7500.2	567.6	7.57%
Lower Trout Creek	3538.4	579.6	16.38%
Lower Upper Truckee River	4292.4	635.1	14.80%
Middle Upper Truckee River	4033.6	458.2	11.36%
Osgood Swamp	3145.6	534.7	17.00%
Saxon Creek	5397.2	495.0	9.17%
Tallac Creek	2790.1	246.7	8.84%
Taylor Creek	4985.1	412.7	8.28%

Equivalent roaded acres (ERA) are used to estimate the impacts of various land use activities in a watershed. The ERA method relates the relative magnitude of disturbance from land use activities compared to an acre of road disturbance. Land uses are assigned a coefficient based on relative impact, ranging from 1.0 for roads, structures, and other impervious surfaces to 0.0 for land uses that have a negligible or positive impact on the soil hydrologic properties, such as planting (Table 3-66). ERA can then be related back to TOC.

The CWE ERA analysis considers the proposed project activities in addition to past, present and reasonably foreseeable future actions, using the process prescribed for the Pacific Southwest Region of the Forest Service (FS Handbook 2520, Ch 20, 1988). Disturbance from current land uses and past, present, currently proposed, and foreseeable future project activities within each watershed were estimated for this CWE analysis. Past activities considered in the analysis include previous vegetation management activities (dating back to 1988) such as CTL, WT, hand, and helicopter treatments, landings, prescribed underburning, pile burning, and natural occurrences such as wildfires. Disturbance coefficients developed by watershed scientists from the LTBMU, and adapted from coefficients developed by the Eldorado and Tahoe National Forests were applied to each type of ground-disturbing activity.

Table 3-66. Equivalent roaded acre coefficients used for different management activities in the South Shore CWE analysis

Management Practice	ERA Coefficient
Vegetation Removal	
Whole Tree Harvest	0.12
Forwarder/Processor/CTL	0.07
Forwarder/Processor/CTL over snow	0.01
Hand Thinning	0.01
Helicopter	0.01
New Landings	0.80
Existing Landings (assume ½ recovered)	0.40
Landings after subsoiling	0.08
Site Preparation	
Hand piling	0.005
Hand Pile Burning	0.01
Underburning	0.03
Chipping/mastication	0.035
Wildfire	
High intensity (0-40% cover)	0.65
Moderate intensity (40-60% cover)	0.45
Low intensity (>60% cover)	0.25
Other	
Unpaved Roads and Trails	0.80
Unpaved Roads after subsoiling	0.08
Ski runs	0.20
Impervious Surfaces (paved roads and buildings) – obtained from IKONOS and GIS	1.00

The ERA coefficients are multiplied by the acres of the particular land use or management activity to determine the ERA for that use or activity. The total ERA from all land uses in each watershed is compared to TOC for that watershed in order to define the risk ratio using the following equation:

Risk Ratio = ERA/TOC

A risk ratio below 1.0 (100%) indicates no risk of adverse impacts to the watershed, while a risk ratio above 100% indicates the need for more detailed analysis, including site specific field evaluations, in order to determine the potential impacts of the proposed treatments and the design features required to minimize those impacts.

The ERA method assumes no recovery from roads that remain in use. Roads are often connected hydrologically to channels, and unlike the other disturbances listed above, the land covered by roads may not recover over time. However, a straight line recovery over twenty years is assumed for other ground disturbing activities, such as vegetation management activities and landings. Recovery is reflected in the model by applying a recovery coefficient to each past activity. A 20-year recovery was also assumed for the Angora Fire, although it is likely that the recovery of soil hydrologic function after wildfire occurs more rapidly (on the order of 3 to 5 years). Therefore, ERA calculations in areas burned by the Angora Fire provide a conservative estimate of the potential for disturbance and risk.

While the ERA analysis methodology may not provide a complete picture of watershed effects, it allows for a comparison of alternatives regarding the potential watershed impacts from proposed treatments. The coefficients are applied to an area and summed, so if a project area has 10 acres with a 25% decrease in permeability, the CWE analysis assumes that this is equivalent to 2.5 impermeable acres. However, 10 acres with a 25% reduction in permeability may not have the same hydrologic response as 2.5 acres of impermeable surface. Furthermore this model is not spatially specific (e.g., it does not account for whether treatments are near a stream course or not), so it is not known whether eroded material reaches a water body or is deposited on a slope elsewhere. Nonetheless, Cumulative Watershed Effects analyses that define a TOC for HUC7 watersheds within a project area utilizing ERAs are a standardized method and provide a useful comparison of effects among alternatives.

Cumulative Watershed Effects

Alternative 1

By implementing the No Action alternative, the stand conditions in this area will remain very dense with high fuel loads. As a result, the south shore region would be more susceptible to a high severity wildfire. Refer to the Watershed Condition Effects section of this report for more details about the potential impacts that wildfire might have if no action is taken at this time to reduce fuel loading in the South Shore project area. However, with the No Action alternative, there would be no activities to produce direct or indirect effects, so there would be no cumulative effects.

Alternatives 2 and 3

Cumulative Watershed Effects (CWE) Assumptions

For the South Shore project CWE analysis, several assumptions were made to inform the analysis and to ensure consistency with other LTBMU resource areas. These assumptions are detailed below.

- The majority of landings proposed for use in the South Shore project (approximately 80%) already exist on the landscape from forest treatments implemented roughly 10-25 years ago. Therefore, 80% of all proposed landings were assumed to have recovered halfway toward their reference condition (i.e. they were assigned a 0.40 ERA coefficient instead of 0.80). The remaining 20% of the landings were assumed to represent new disturbance on the landscape and were given the standard 0.80 ERA coefficient (Table 3-66).
- Although many of the landings used for South Shore treatments will be decommissioned after project completion, the exact number and location of landings that will be decommissioned is not known, so the CWE analysis assumed the 20 year recovery period for all landings. This applies a more conservative analysis because the decommissioning is not credited with reducing impacts from landings in the CWE analysis.
- Landings in WT mechanical treatment units were assumed to be one acre in size, and landings in CTL mechanical units were assumed to be ¼ acre in size. Although the actual landing sizes will vary, the WT landings will generally be larger than the CTL landings, and these acreages provide a useful estimate of average landing size for each treatment type in order to compare effects between the action alternatives.
- Decommissioned roads were given the coefficient for unpaved roads after subsoiling (0.08).
- For analysis purposes, all urban lot stands proposed for hand treatments were assumed to receive hand piling and burning as the secondary treatment, rather than chip and/or masticate. This assumption was based on the likelihood that only a small portion may be chipped or masticated. The majority of the urban lot stands are in close proximity to roads, facilitating easy removal of material from the site. Many urban lots would not

receive any secondary treatment because felled material would be removed from the site manually. Therefore, hand pile and burning provides a maximum estimate of impacts in hand treated urban lots.

- For the CWE analysis, all urban lot hand treatments were assumed to occur in 2009, and all CTL urban lot treatments were assumed to occur in 2010. In reality, urban lot hand treatment stands will be treated as soon as possible, but will not likely be completed all in one year. In addition, CTL urban lot stands would be treated when the nearby CTL stands are treated, not necessarily in 2010.
- The recommended ERA coefficients for wildfire at varying intensities (i.e. low, moderate, and high) are actually a range of values. For the South Shore CWE analysis, the highest value in the range for varying fire intensities was applied so as to consider the worst case scenario. This high end of the recommended range is represented in the ERA coefficients used for this project in Table 3-66.
- The LTBMU typically waits approximately two years after piles are created in order to season the material for optimum burning conditions. It was assumed that hand pile burning would occur within hand treatment units two years after the initial treatment is implemented.
- Where underburning is proposed as a secondary treatment in hand or mechanical units, it was also assumed to occur two years after the last prior treatment. For mechanical units this would be two years after the initial treatment, for hand pile and burn units this would be two years after the initial hand piles are burned.
- Prescribed underburning may be substituted for hand piling and burning within hand treatment units in meadows and aspen stands in some instances. Because this would be limited to only a few of the SEZ hand treatment units, and effects have been found to be minimal, it was not included in the CWE analysis.
- The following parameters were adopted from the South Shore Landscape Analysis for inclusion of roads in the CWE (USDA FS LTBMU 2004). The width applied to roads in the project area was based on the road description (i.e. collector, local, etc). These values are presented in Table 3-67 below.

Table 3-67. Assumed road widths for CWE analysis of roaded acres

Road Description	Width of travel surface (feet)
Arterial	20
Collector	16
Local	14
State and Federal Highways	40
Private, City, County, and other	16
FS, Non-system	12
Trails	4

- Additional width was added for the CWE analysis to account for the entire road prism (or the overall “footprint” of the road or trail) consistent with the CWE analysis approach used for the South Shore Landscape Analysis. For road and trail segments on gentle slopes (<35%), road widths shown in Table 3-67 above were multiplied by 1.25. For road or trail segments on steeper slopes (>35%), road widths shown above were multiplied by 2.5.
- Past and reasonably foreseeable future channel and SEZ restoration activities were considered qualitatively in the effects (see Stream Channel Condition section), but were not included in the ERA analysis. Because existing degradation of stream channels and SEZs is not included in the ERA methodology unless there is existing impervious

coverage (i.e. there is no coefficient for failing channel banks or incised channels), there is no method to credit channel and SEZ restoration activities with a reduction in ERA.

- In addition, a restoration project for the Angora burn area is currently in the planning process. Because this project is still under development, and a decision has not yet been made about what the project would consist of, the proposed Angora restoration project treatments could not be included in the CWE ERA analysis model for South Shore. At this time, it is anticipated that the Angora restoration project would include approximately 1,400 acres of vegetation management, 1,200 feet of channel restoration, 8 acres of aspen planting, 13 miles of road and trail construction, removal of 2 miles of roads and trails from SEZs, and decommissioning of nearly 20 miles of roads and trails. Although some watershed effects may occur as a result of the vegetation management and road and trail activities, the proposed restoration, revegetation, and decommissioning measures are expected to largely offset any negative effects resulting from project activities.

CWE Results

The South Shore project analysis area intersects 21 HUC7 watersheds (Map 13). The areas outside of the South Shore treatment units and within the affected watersheds include Forest Service managed lands, state lands, and other privately owned lands. The 18 of the 23 HUC7 watersheds that intersect the South Shore analysis area where activities would occur are included in the CWE analysis for this project.

Table 3-68 presents a summary of the CWE analysis results using the ERA methodology for the five years of proposed South Shore project implementation, and the final year of the model simulation. This table also displays the maximum change in risk ratio (RR) associated with proposed treatments in each watershed for both action alternatives. (See the watershed specialist report, located in the project file for the complete CWE analysis for each of the project area watersheds.)

As can be seen in Table 3-66, existing roads, trails and impervious coverage from development account for most of the ERA in the South Shore watersheds. Specifically, four of the 18 HUC7 watersheds analyzed exhibit an ERA over TOC, (see highlights in Table 3-66), before the proposed South Shore treatments are applied (i.e. RR > 100%). Disturbance in these watersheds is primarily attributable to impervious coverage from roads and buildings, with some additional impacts from trails, ski runs, and wildfires. Three of these four watersheds are over TOC from impervious coverage alone, including Bijou Frontage, Camp Richardson Frontal, and Lower Upper Truckee River (i.e., below Christmas Valley). Each of these three watersheds is located nearer to the Lake, where the primary land use is urban development. The 4th watershed that is over TOC before proposed treatments are applied is the Angora Creek HUC7, which was pushed over TOC by the recent Angora wildfire. These are the only watersheds in the South Shore analysis area that are over TOC or that go over TOC during the analysis period, and they are over TOC because of the existing conditions in these watersheds.

Because of the need to achieve a desired condition in these watersheds by reducing hazardous fuel loads and wildfire risk, the purpose and need for the South Shore project would not be met without treatments in the four watersheds that are over TOC. Project activities that are proposed in HUC7 watersheds that are over TOC have been designed with scheduling and treatment types to reduce impacts for Alternative 2 and to minimize impacts with Alternative 3.

The South Shore treatments in either Alternative 2 or 3 do not cause an increase in ERA over TOC for any of the project area watersheds. Additional changes to the timing or type of treatments would not affect the number of watersheds that are over TOC. The remaining 14

HUC7 watersheds in the South Shore analysis area exhibit ERAs that are well below their TOC (Table 3-68).

Several triggers have been agreed to by the LTBMU and Lahontan Water Board in order to determine whether more detailed analysis, including site specific field evaluations, is needed to evaluate the potential impacts of the proposed treatments and identify design features needed to reduce those impacts and meet water quality requirements. These triggers are based on outcomes from the CWE analysis for a given watershed. The primary triggers for additional monitoring requirements are: 1.) an increase in RR of 20% or more in watersheds currently below their TOC, 2.) an increase in RR of 5% or more in watersheds that are currently over their TOC, and 3.) an ERA that increases above TOC due to project activities.

For Alternative 2, two watersheds exhibit an increase in RR over the course of the project of more than 20% as a result of the proposed treatments (Table 3-68). These watersheds are Tallac Creek, which experienced a 25.7% increase in RR, and Taylor Creek which experienced a 25.2% increase. While this is a substantial increase in RR over a short period of time, these watersheds still remain below their TOC during the analysis period. If Alternative 2 is selected, additional monitoring would be required in these watersheds to identify whether or not additional mitigation measures are necessary and to ensure that cumulative watershed effects are avoided.

For Alternative 3, treatments and acreages were modified in both the Tallac and Taylor Creek watersheds such that the percent increase in RR from proposed treatments in these watersheds was reduced to 17.9% and 15.4%, respectively. Under Alternative 3, no additional monitoring would be required in these watersheds.

Another trigger for more intensive mitigation measures or monitoring is an increase in RR of 5% or more in watersheds that are already over TOC. With both Alternative 2 and 3, this occurs in only one HUC7 watershed, Camp Richardson Frontal (Table 3-68). The treatments proposed in Alternative 2 result in a maximum increase in RR of 10.1% over the analysis period. For Alternative 3, a 7.4% maximum increase would occur in the first year of implementation. This particular watershed was impacted substantially by the Angora Fire, and was already over TOC before the wildfire due to the large amount of impervious cover from roads and urban development. Treatments in this watershed have been minimized to the extent feasible while still meeting the purpose and need in Alternative 3. The Camp Richardson Frontal watershed would receive additional monitoring to track the watershed response to proposed treatments and identify areas that may need additional mitigation measures.

The other three watersheds that are over TOC based on existing conditions do not experience an increase in RR of 5% or more from project activities, and do not require any additional analysis or monitoring. The remaining 14 HUC7 watersheds in the South Shore analysis area are not over TOC, do not go over or near TOC due to project activities, and do not exhibit a large increase in RR during the period of analysis. Treatment in these watersheds will not require any additional monitoring or mitigation measures to meet Lahontan Water Board requirements.

The action alternatives would result in some increased disturbance in the affected watersheds. The application of BMPs would minimize on-site impacts associated with the proposed project activities, while road maintenance and stream crossing improvements would reduce delivery of sediment to streams in the project area. The proposed treatments were designed to minimize potential adverse impacts to soil and water quality within the project area, while recognizing the existing watershed conditions due to lasting impacts of the Angora fire, existing road densities, and stream crossings.

Based on the results of the CWE analysis, with implementation of BMPs and design features (including RCA designations and prescriptions), the risk of adverse cumulative effects to soil and water resources within the project area is low and beneficial uses of the Lake Tahoe Basin would be maintained. The analysis concluded that there is no loss of aquatic or riparian habitat and therefore there is no cumulative contribution to the loss of suitable habitat for aquatic and riparian dependent species within the South Shore analysis area.

Table 3-68. CWE Results Summary for Alternative 2 and Alternative 3 (watersheds over 100% RR are highlighted)

HUC7 Name	Alternative 2 Existing Conditions				Alternative 2 Risk Ratio Associated with South Shore Treatments						
	Total Acres	TOC %	2008 RR without wildfires	2008 RR with wildfires	2008	2009	2010	2011	2012	2018	Max RR change
Angora Creek	3693.6	14.44%	44.86%	223.60%	227.85%	217.71%	208.51%	199.08%	188.84%	127.59%	4.25%
Benwood Meadow	3682.8	7.77%	6.55%	47.20%	47.41%	44.92%	42.29%	39.63%	36.75%	18.94%	0.21%
Big Meadow Creek	3271	5.91%	15.51%	24.09%	31.00%	30.22%	29.57%	33.60%	32.57%	25.68%	9.50%
Bijou Frontage	3763.3	12.67%	179.68%	179.71%	180.46%	181.14%	181.41%	181.78%	181.63%	180.72%	2.07%
Camp Richardson Frontal	2658	14.68%	107.77%	176.88%	185.14%	186.97%	183.50%	182.50%	177.59%	148.19%	10.09%
Cascade Creek	3019.1	4.11%	20.13%	20.13%	20.13%	20.00%	19.86%	19.79%	19.73%	19.40%	0.00%
Cold Creek	8172.9	5.89%	28.50%	28.52%	28.52%	28.31%	29.44%	29.21%	28.97%	27.57%	0.92%
Echo Creek	3459.7	4.66%	27.39%	27.39%	28.59%	30.24%	30.77%	38.14%	37.58%	34.24%	10.75%
Glen Alpine Creek	6935.7	3.19%	16.64%	16.64%	16.64%	16.64%	17.26%	17.23%	17.61%	17.30%	0.97%
Grass Lake	4032.6	6.43%	21.27%	21.27%	31.61%	31.14%	31.15%	33.33%	32.81%	29.51%	12.07%
Headwaters of Trout Creek	7500.2	7.57%	9.16%	9.16%	11.65%	11.36%	20.03%	21.31%	20.71%	12.93%	12.15%
Lower Trout Creek	3538.4	16.38%	71.44%	71.44%	77.53%	78.53%	82.47%	88.39%	87.24%	80.38%	16.95%
Lower Upper Truckee River	4292.4	14.80%	131.30%	146.05%	148.39%	148.32%	147.00%	146.72%	145.20%	136.95%	2.33%
Middle Upper Truckee River	4033.6	11.36%	53.77%	53.77%	58.71%	60.01%	62.25%	65.25%	64.67%	60.89%	11.48%
Osgood Swamp	3145.6	17.00%	62.22%	72.45%	75.55%	75.58%	74.86%	79.27%	77.90%	69.91%	6.83%
Saxon Creek	5397.2	9.17%	25.28%	25.28%	27.01%	26.87%	36.27%	36.63%	36.50%	31.40%	11.34%
Tallac Creek	2790.1	8.84%	32.90%	34.40%	38.46%	49.42%	58.02%	60.07%	58.05%	45.21%	25.67%
Taylor Creek	4985.1	8.28%	62.87%	70.23%	70.37%	84.14%	95.47%	93.44%	89.12%	67.86%	25.24%

Table 3-68. CWE Results Summary for Alternative 2 and Alternative 3 (continued)

HUC7 Name	Alternative 3 Existing Conditions				Alternative 3 Risk Ratio Associated with South Shore Treatments						
	Total Acres	TOC %	2008 RR without wildfires	2008 RR with wildfires	2008	2009	2010	2011	2012	2018	Max RR change
Angora Creek	3693.6	14.44%	44.86%	223.60%	225.39%	215.28%	206.34%	196.77%	186.67%	126.22%	1.78%
Benwood Meadow	3682.8	7.77%	6.55%	47.20%	47.20%	44.65%	41.89%	39.20%	36.32%	18.65%	0.00%
Big Meadow Creek	3271	5.91%	15.51%	24.09%	29.96%	29.18%	28.89%	29.55%	28.74%	23.29%	5.86%
Bijou Frontage	3763.3	12.67%	179.68%	179.71%	179.71%	180.39%	180.65%	181.03%	180.88%	179.97%	1.32%
Camp Richardson Frontal	2658	14.68%	107.77%	176.88%	184.26%	182.54%	178.66%	180.73%	175.88%	147.69%	7.39%
Cascade Creek	3019.1	4.11%	20.13%	20.13%	20.13%	20.00%	19.86%	19.80%	19.73%	19.40%	0.00%
Cold Creek	8172.9	5.89%	28.50%	28.52%	28.52%	28.31%	29.48%	29.25%	29.01%	27.59%	0.96%
Echo Creek	3459.7	4.66%	27.39%	27.39%	28.53%	30.24%	30.73%	31.55%	31.32%	30.39%	4.28%
Glen Alpine Creek	6935.7	3.19%	16.64%	16.64%	16.64%	16.64%	17.26%	17.23%	17.61%	17.30%	0.97%
Grass Lake	4032.6	6.43%	21.27%	21.27%	28.25%	27.91%	28.56%	29.99%	29.65%	27.57%	9.10%
Headwaters of Trout Creek	7500.2	7.57%	9.16%	9.16%	12.45%	11.55%	15.27%	16.58%	16.50%	10.11%	7.42%
Lower Trout Creek	3538.4	16.38%	71.44%	71.44%	77.38%	78.53%	79.72%	82.52%	81.67%	76.62%	11.08%
Lower Upper Truckee River	4292.4	14.80%	131.30%	146.05%	147.46%	148.15%	146.89%	146.33%	144.83%	136.72%	2.10%
Middle Upper Truckee River	4033.6	11.36%	53.77%	53.77%	58.25%	59.46%	62.42%	62.91%	62.46%	59.49%	9.15%
Osgood Swamp	3145.6	17.00%	62.22%	72.45%	73.25%	74.77%	74.14%	77.03%	75.77%	68.52%	4.58%
Saxon Creek	5397.2	9.17%	25.28%	25.28%	27.00%	26.85%	34.51%	35.84%	35.53%	30.76%	10.56%
Tallac Creek	2790.1	8.84%	32.90%	34.40%	39.48%	45.42%	51.58%	52.32%	50.94%	40.49%	17.91%
Taylor Creek	4985.1	8.28%	62.87%	70.23%	70.23%	76.52%	85.33%	85.64%	81.48%	62.88%	15.41%

E. Aquatic Wildlife

Scope of the Analysis, Issues, and Indicators

Species lists are based on the January 31, 2008 (verified on August 14, 2008) list of federally threatened, endangered, proposed, and candidate species for the Lake Tahoe Basin Management Unit (LTBMU) from the U.S.D.I. Fish and Wildlife Service (USFWS; http://sacramento.fws.gov/es/spp_list.htm). The USDA Forest Service wildlife sensitive species list is based on the Pacific Southwest Region's list of 1998, as amended. These lists are the most current versions for the LTMBU.

The analysis presented here discloses the effects of the three alternatives for the South Shore project on the following threatened (T), endangered (E), proposed (P), candidate (C), and/or Forest Service Sensitive (FSS) aquatic species that are known or suspected to occur in the project area:

Threatened:

Lahontan cutthroat trout (*Oncorhuynchus clarki henshawi*)

Forest Service Sensitive:

Lahontan Lake tui chub (*Gila bicolor pectinifer)*
Great Basin rams-horn (*Helisoma (Carninifex) newberryi*)

Of the species that are being considered further in this section, only the Lahontan cutthroat trout requires consultation with the US Fish and Wildlife Service (USFWS). On May 13, 2008 a meeting occurred between Richard Vacirca, LTBMU forest fish biologist and Chad Mellison, USFWS consultation biologist. The purpose of the meeting was to review the South Shore project with the USFWS, overview fuel treatment objectives for RCAs, and discuss project level effects for Lahontan cutthroat trout (LCT). Fuel treatment units of concern with regard to LCT are those that occur adjacent to the Upper Truckee River. Since 2006 LCT have been documented migrating downstream from the Meiss Meadow complex and currently occupy habitat in the Upper Truckee River approximately 2 miles above the top of Christmas Valley. It was determined that although current fish surveys in the Upper Truckee River did not observe LCT residing in the project area, there is potential for the species to occupy these habitats in the future when fuel reduction activities occur. Informal consultation was initiated with the USFWS for the South Shore project Draft EIS so recommendations for the alternatives can be incorporated into the Final EIS. Formal or informal consultation will be requested after a preferred alternative is chosen.

No critical habitat for federally-listed endangered, threatened, proposed, or candidate species has been designated by the USFWS on the LTBMU. However, the LTBMU Forest Plan as amended by the SNFPA allocates a critical aquatic refuge (CAR) in the Upper Truckee River watershed that extends into fuels treatments under both action alternatives. The Upper Truckee River CAR was established to protect critical aquatic resources, for LCT.

Management direction specific to the Lahontan cutthroat trout (LCT) for the LTBMU comes primarily from the 1995 LCT recovery plan (USFWS 1995). This plan identified the western Lahontan Basin (comprised of the Truckee, Walker and Carson Rivers) as one of the three distinct population segments (DPS). The western DPS are large waterbodies, which include Lake Tahoe, Pyramid Lake, Independence Lake and Walker Lake. The recovery plan states that historic and current LCT populations tied to them are important to the recovery of the species. Currently LCT occupy stream and lake reaches in the headwaters of the Upper Truckee River watershed (Map

16). The recovery plan also identified the need for basin-specific recovery implementation teams (RITs) be formed to develop action plans and implement strategies for LCT. In 1999 LCT RITs were formed for the Truckee and Walker River basins and in 2007 the Tahoe Basin RIT was formed as well. The Tahoe Basin RIT is currently in the process of developing the recovery action plan for Lake Tahoe, which will assess the species historic and current population status, review aquatic habitat conditions, summarize basin-wide threats to LCT persistence, and identify conservation elements and opportunities for recovery. Conservation activities have been ongoing in the Upper Truckee River and Fallen Leaf Lake prior to the formation of the Tahoe Basin RIT.

Whether technical assistance should be requested for the candidate species mountain yellow-legged frog (MYLF) was discussed with USFWS. Both USFWS and LTBMU agreed that although MYLF habitat may exist within the project area, recent amphibian surveys support the finding that the species does not occur within the project area; therefore technical assistance would not be required. Because MYLF do not occur within the area of South Shore project activities or impacts, MYLF will not be discussed further.

The concern for aquatic species is to maintain high quality habitat. Indicators of aquatic habitat quality include maintaining stream shading, maintaining water temperatures, bank stability, and water quality. Specific management direction for aquatic ecosystems is tied to riparian conservation objectives (RCOs), riparian conservation areas (RCAs) and critical aquatic refuges (CARs). The SNFPA provided specific Forest-wide standards and guidelines for RCAs and CARs and addressed conservation needs for species of concern (threatened, endangered, candidate and sensitive). Design features to achieve RCOs are described in Chapter 2.

The following indicators are used as measures of project effects on aquatic habitat and species:

- Fish population status and trend and distribution
- Stream shade and water temperature
- Large woody debris (LWD)
- Sediment

Existing Conditions

Aquatic Species Population and Distribution

Lake Tahoe's fishery pre-1900 was dominated by a single predator, Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*). This trout grew to a large size (14 kg), utilizing primarily bottom-feeding chubs (*Siphatales bicolor pectinifer*) and native zooplankton as their food source. Tributaries to the lake provided spawning grounds (Vander Zanden et al. 2003, Chandra et al. 2005). Historically, 8 fish taxa were known to be native to the Lake Tahoe Basin (Miller 1951, Frantz and Cordone 1970, and Vander Zanden et al. 2003). During the last 130 years the biological assemblage of the Lake Tahoe Basin has been altered intentionally and unintentionally by the introduction of numerous nonnative species.

The first series of non-native trout introductions occurred at the end of the 19th century. They included nine species of trout thought to be suited to Tahoe's environment. Only rainbow trout (*O. mykis*), brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), and brook trout (*S. fontinalis*) survived and persist in the basin today. Predatory impacts from lake trout combined with over fishing, hybridization, and siltation of spawning streams contributed to the extirpation of Lahontan cutthroat trout from Lake Tahoe by 1939 (Cordone and Frantz 1968, Moyle 2002).

Today, due the restoration efforts of state, and federal agencies a reproducing population of LCT exists in the upper headwaters of the Truckee River. This population is outside of the geographic scope of the South Shore project and will not be affected. There have been LCT stocked into

Echo, Fallen Leaf, Cascade and Marlette lakes but none of these fish have been documented as reproducing.

Non-native trout and Kokanee salmon dominate the streams associated with the South Shore project. These species have essentially replaced Lahontan cutthroat trout as the top predator in the stream systems of the Lake Tahoe Basin. Lower stream reaches with lower gradients and more available habitat (pools, cover, substrate), are dominated by the fall spawning brown trout, and the spring spawning rainbow trout. Brown trout and rainbow coexist without much aggressive interaction due to their differing life histories and habitat utilization. However, brown trout and brook trout display a high degree of habitat overlap; they both spawn in the fall and feed primarily on macroinvertebrates. In general brown trout out-compete brook trout in stream segments that are larger with greater volumes of water, and brook trout are displaced upstream (Fausch and White 1981). These distribution patterns are found throughout the Lake Tahoe basin and within the project area.

Stream Shading and Water Temperature

Vegetation, including conifers and riparian shrubs, which occurs in valley bottoms and along margins of streams provides shade and influences water temperatures by buffering solar radiation (Beschta 1997, Quigley 1981). Decreases in shade provided by vegetation can affect stream temperature. In general, reductions greater than 50% in the riparian canopy cover correlates with increases in stream temperature. Data presented in Table 3-69 summarizes stream habitat characteristics related to shade and temperature along perennial streams within the South Shore project area. These data were collected between 1988 -1996, and are the best data sets available. Temperatures ranged from 48-76°F across all of the streams within the project area. These temperatures closely match stream temperatures taken from USGS gauges between 1999-2002 on Trout Creek and the Upper Truckee and correlate to habitat data collected by the LTBMU between 1988 -1996.

Table 3-69. Existing instream habitat within project area

Stream/Habitat	Dominant Channel Type	Dominant Substrate Type	Mean Instream Cover (%)	Mean Shade (%)	Stream Temp Range (June-Sept)	Dominant Instream Cover Type
Heavenly Valley	C-4	sand/fines	37	71	51 – 63	swd (<.3m)
Glen Alpine	B-2/3	boulder/cobble	48	23	47 - 69	boulders
Big Meadow	C-3	gravel	39	28	49 – 65	Swd (<.3m)
Cold Creek	A-2	gravel / sand	27	45	40 – 62	Undercut banks / boulders
Taylor	B-2	cobble	17	16	58 – 76	undercut banks / boulders
Tallac	D-6	fines	26	33	48 – 67	aquatic vegetation
Echo	A-2	cobble/boulder	28	42	54 – 69	Cwd (>.3m) / boulder
Saxon	A-3	sand	27	66	51 – 62	Swd (<.3m)
Grass Lake Ck.	A-2	boulder	44	65	48 – 62	boulder
Trout	C-6	sand	22	26	48 – 68	Swd (<.3m)
Angora	C-4	sand	24	33	55 – 72	terrestrial vegetation

The data show differences in maximum daily temperatures from stream shading, but mean and minimum daily temperatures were not influenced by stream shading (e.g. Trout Creek, Figure 3-2). Streams with the least amount of shade have the highest maximum temperatures. Johnson

(2004) found similar results in streams that were artificially shaded when compared to clear-cut sections of riparian forest. Forest harvest in riparian areas has been shown to produce increases in stream temperatures, and the magnitude of these increases varies among sites and regions (Swift and Messer 1971). Sites where only the understory (little canopy affect) was removed generally exhibited small effects on stream temperatures compared to sites where both overstory and understory were removed or burned (Lynch et al. 1984).

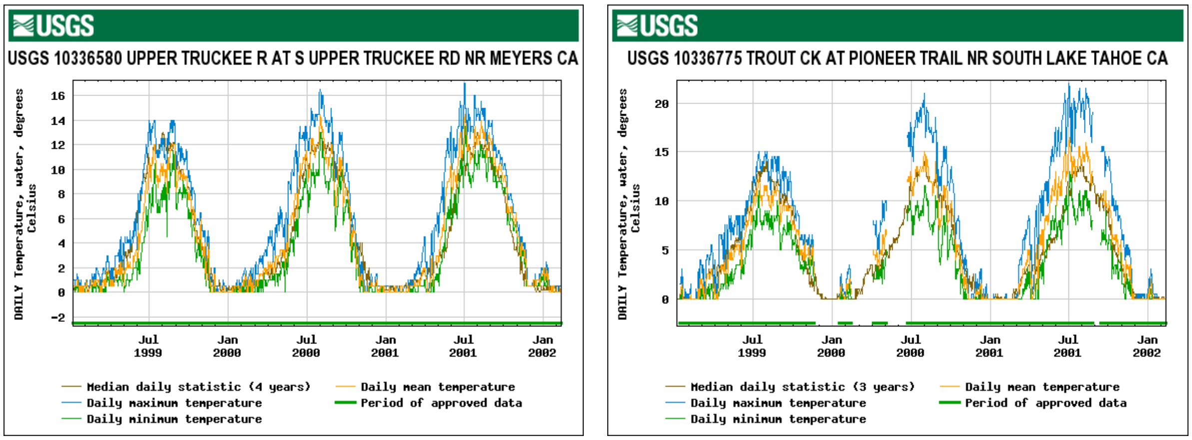


Figure 3-2. Average daily temperatures for Trout Creek and Upper Truckee River between 1999-2002

Large Woody Debris (LWD)

Large woody debris (LWD) is a natural component of unmanaged streams, and has a very complex role in hydrologic, chemical, and biological processes (Lehane et al. 2002). LWD has been found to increase habitat diversity, through formation of pools and creation of resting places from swift currents. LWD also enhances the quality of food available to fish (Angermeier and Karr, 1984).

Present and future levels of LWD are influenced by living, dead, and dying trees within the riparian corridor. Trees closer to the stream than they are tall will directly influence the stream if they fall towards the stream channel. Table 3-70 summarizes LWD data collected in the field seasons of 2005 and 2006. Current LWD levels are at or above the range of natural variability found within the Sierra Nevada (Berg et al. 1998). The South Shore project will not remove or have an effect on existing in-channel wood (large or small). Past management such as fire suppression without fuel reduction precipitated the current condition of excess LWD. Many of these channels are incised or down-cut which resulted in drier RCA conditions and promoted increased conifer encroachment. Tributaries such as Trout, Upper Truckee, Saxon, and Tallac creeks have experienced such down-cutting and the effect is apparent in the current condition of the RCA/SEZ. Subsequently, it is estimated that LWD within the channels of these tributaries is within or above the range of natural variability.

Conversely, Taylor Creek has experienced different management effects. Taylor Creek was found to contain the least amount of LWD per mile among any streams within the project area. There are several reasons for the lack of LWD in Taylor Creek: Large woody debris has been removed from Taylor Creek to facilitate Kokanee migration; a dam is located at the upper reaches of Taylor Creek, which prevents LWD recruitment downstream; and hazard trees that would likely have been recruited into the channel have been removed due to their proximity to Highway 89 and associated roads. The design criteria for having a fisheries biologist onsite during implementation to assess shade and enhance large woody debris recruitment for Taylor Creek during fuels treatment in the RCA would provide an opportunity to enhance the physical and biological process in Taylor Creek.

Table 3-70 represents a comparison of LWD measurements from Berg et al. (1998) and USFS habitat data from south shore streams. Although variability of sites exists (i.e. valley and stream type, plant associations, level of current/past management, etc.), Berg et al. (1998) can be useful in indicating what levels potential of LWD can occur across a wide range of streams.

Table 3-70. Existing Large Woody Debris (>.3m diameter) within project area tributaries*

LTBMU Streams				**Berg et al. 1998**	
Stream Reach	**Distance of Stream Surveyed (miles)**	**Number of WD pieces**	**Amount of WD per unit length (miles)**	**Stream Reach**	**Amount of WD per unit length (miles)**
Angora Creek	1.51	134	88.74	East Fork	105.60
Cookhouse	0.42	25	59.52	Empire	104.10
Christmas Valley (Upper Truckee)	0.46	46	100.00	Lavezolla	32.00
Echo Creek	0.07	4	57.14	Badenaugh	11.20
Grass Lake Creek	0.84	64	76.19	Sagehen	35.20
Osgood Swamp Outlet	0.7	28	40.00	Pauley	40.00
Saxon Creek	1.65	183	110.91		
Trout Creek	5.4	538	99.63		
Taylor Creek	0.9	24	26.67		
Tallac Creek	1.2	119	99.17		

*compared to Berg et al. 1998 “Function and dynamics of woody debris in stream reaches in the central Sierra Nevada”

Sediment

The amount and type of sediment within a stream system influences aquatic habitat quality and species diversity. For example, fine sediment accumulation in a gravel bed stream can decrease the level of fish spawning and prevent eggs from hatching.

Sediment delivery to streams originates from two sources: hill slopes and channel banks. The amount and extent of erosion from hill slopes and channel banks is variable and influenced by both natural processes and human impacts. Human-caused hill slope erosion can impact critical aspects of aquatic habitat, such as spawning (Eaglin and Hubert 1993). Channel bank erosion within the South Shore project area is related to channel incision and/or aggradation, and is occurring in drainages such as Saxon Creek, Angora Creek and Upper Truckee River. Influences on current hill slope and bank erosion processes include roads, channelization, urban encroachment into SEZs and legacy effects from past livestock grazing.

Potential fine sediment sources may originate from fuel treatments in RCAs where tree thinning methods disturb soils, skid trails and landings, and from existing and new temporary roads. Road density is an indicator of the concentration of roads in a given geographic area and can correlate to the density of stream crossings in a given drainage network (Haskins and Hayhood 1997). It can be a useful tool in accessing the potential overlap of roads with areas of aquatic habitat, and with areas where soil productivity and erosion may be of concern (Maholland and Thomas 2005).

The existing road system in the South Shore project area is a combination of native surface, improved native surface, gravel, or asphalt surface roads with associated stream crossings (perennial and intermittent). Some decommissioned roads may be used during vegetation projects as temporary roads. In some cases, stream crossing restoration has occurred that reduced impacts from roads and stream crossings (i.e. Trout Creek). In other cases, restoration is needed to provide fish passage and natural sediment transport (i.e. Spring Creek and Saxon Creek).

Species Accounts and Status

Lahontan cutthroat trout

Lahontan cutthroat trout (LCT) was listed as an endangered species in 1970 (Federal Register Vol. 35, p.13520). In 1975, under the Endangered Species Act (ESA) of 1973 as amended, LCT was reclassified as threatened. The change facilitated management and allowed for regulated angling (Federal Register Vol. 40, p.29864). In 1995, the U.S. Fish and Wildlife Service (USFWS) released its recovery plan for LCT, encompassing six river basins within historic LCT range, including the Truckee River basin.

Historically, LCT occurred throughout the Truckee River drainage from the headwaters south of Lake Tahoe in California downstream to Pyramid Lake (Gerstung 1988). The LCT in Pyramid Lake and Lake Tahoe were a valuable food source regionally, and were consumed by the Pyramid Lake Paiute Tribe, the Washoe Tribe, early explorers and commercial fishermen (Fowler and Bath 1981). By 1938 LCT had been eliminated from the Tahoe Basin as a result of overfishing, introduction of non-native trout, and habitat modification.

Lahontan cutthroat trout were successfully restored to the headwaters of the Upper Truckee River in Meiss Meadows (adjacent to the planning area) in the late 1980s and early 1990s through a cooperative effort between the CDFG, USFS and USFWS. Recovery efforts resulted in a reproducing population in the upper headwaters of the Truckee River. Non-native brook trout were initially removed from the Upper Truckee River prior to the LCT introduction by means of rotenone application. It was suspected that brook trout were illegally reintroduced into the Meiss Meadow area after chemical treatment from adjacent source populations downstream. Since that time brook trout removal has utilized manual electro-fishing methods. Brook trout were not found in sampling of the headwaters during recent removal efforts in 2007, and removal efforts continued to occur in 2008 (estimated to be the final year). The Meiss Meadow population is one of the only high-elevation meadow populations of LCT in the Sierra-Nevada Mountain Range and also functions as a source population for LCT in lower river segments of the Upper Truckee.

Fish surveys conducted in the Upper Truckee River (Sunset Reach) did not detect LCT within the South Shore project area. Recent snorkel surveys in 2006 and 2007 in the Upper Truckee River above Christmas Valley indicate LCT residing in Meiss Meadows are migrating downstream. It is expected that adult LCT will continue to move downstream and occupy lower basin Upper Truckee River habitats. Therefore, there is potential for LCT occupancy in reaches within the South Shore project portion of the Upper Truckee River when fuel reduction activities commence. However, the number of LCT per square meter is expected to be very low as competition for habitat will occur with introduced trout.

LCT were stocked into Fallen Leaf Lake as part of a USFWS pilot research project to examine their interactions with nonnative lake trout. This is the only lake within the South Shore project area known to contain LCT (Map 16), although reproduction is unknown. Other plantings have occurred, but none have been shown to be reproducing. LCT habitat is present within the project, but competition from the widespread distribution of non-native trout makes their persistence unlikely.

Lahontan Tui Chub

Tui chub occur in wide range of habitats from the Columbia River drainage in the north to central Nevada and California in temperatures ranging from 35 – 86°F. Their typical habitat is quiet water with well developed beds of aquatic vegetation and bottoms of fines (Moyle 2002). Tui chub were not identified in any of the surveys within the South Shore project area. Preliminary results from a warm water fish project suggest that introduced bass may be preying upon Tui chub within their preferred habitats (Kamerath et al. 2008).

Great Basin rams-horn

Great Basin rams-horn snail is native to California and other parts of the western US. The species is known to occur in large lakes and slow flowing rivers (Furnish 2005). These snails characteristically burrow in soft mud and may be almost invisible to detect even when abundant. In Eagle Lake, CA snails were observed only on the top of sand substrate, and only in deeper water (Furnish 2005). Great Basin rams-horn have also been documented in stream systems, such as Hat Creek, CA (Furnish 2005). The species is known to occur in Lake Tahoe and the adjacent slow water stream segments, such as the outflow of the Truckee River (Furnish 2005).

Table 3-71. Species accounts by stream within the South Shore DEIS area

Stream	BK	RT	BT	LCT*	KS	LT	SPD*	PS*	LRS*	TC*	TS*	WWI
Taylor Creek	x	x	x		x	x	x		x		x	x
Upper Truckee	x	x	x	x			x	x	x		x	x
Trout Creek	x	x	x				x		x			
Saxon Creek	x	x					x					
Big Meadow Creek	x											
Grass Lake Creek	x		x									
Echo Creek		x	x				x					
Angora Creek	x	x	x				x	x				
Tallac Creek	x	x	x				x	x	x		x	x
Glen Alpine Creek		x	x				x	x	x		x	

BK=Brook trout, RT=Rainbow trout, BT=Brown trout, LCT=Lahontan cutthroat trout, KS = Kokanee Salmon, LT=Lake trout, SPD=Speckled Dace, PS=Paiute sculpin, LRS=Lahontan redside, TC=Tui chub, TS=Tahoe sucker, WWI=Warmwater invasive species: Bluegill, Bass, Sunfish, Catfish; Native Species are highlighted with an "*".

Direct and Indirect Environmental Consequences

Analysis of direct, indirect, and cumulative effects for the South Shore project for aquatic species and their habitats are bounded in time and space by the same parameters used for hydrological analysis. To avoid unnecessary repetition regarding analysis of effects aquatic species, the following generalized effects analyses for the proposed action and alternatives applies to all species considered in the aquatic BE/BA unless otherwise stated in the species-specific analyses presented afterward.

Alternative 1 (No Action)

The amount of shade provided by conifers is not expected to change from current levels within the next 2-5 years along stream reaches within the South Shore project area. However, shade could slowly decrease over the long-term (> 5 years) as insect and disease outbreaks continue to affect canopy structure and foliage. This potential decrease in shade due to tree mortality may be offset by an increase in riparian shrub species to replace shading as the amount of sunlight penetrating the forest floor increases. An exception to this occurs where LWD is already at excessive levels, spanning streams and functioning as shade.

The amount of LWD within stream channels and along floodplains is expected to increase over the long-term (>5 years) from current levels. This increase would result from tree mortality and cause both an increase in floodplain roughness and an increase in LWD within channels. An increase in LWD within the RCA and SEZ would raise the risk level of high intensity fire in the RCA and potentially result in undesired post-wildfire effects to aquatic habitat from loss of LWD and increase of fine sediment. Existing sediment levels contributed from hill slope processes, including erosion from system roads, would not change. Potential increases in fine sediment from temporary road construction/re-construction would not occur.

Alternative 2 (Proposed Action)

More immediate effects to the future recruitment of LWD potentially result from fuels treatment within the SEZs than would occur under the No Action alternative. Alternative 2 proposes mechanical treatment in RCAs that occur in the WUI, including mechanical treatment in SEZs. Live and dead trees in mechanical thinning units would be removed with a goal of achieving less than 15 tons per acre fuel loading and reducing basal area per acre. Large woody debris that occurs within existing channels would not be removed and would continue to benefit aquatic habitat (i.e. creation and/or maintenance of pools). A portion of the large wood structure would be left intact along the floodplain and continue to function as floodplain roughness.

Although stream shade within SEZs may be reduced slightly over the short-term (< 5 years) it is expected that canopy structure and foliage would become more robust with the release of larger healthier trees while riparian shrubs would increase in size and density as sunlight becomes more available. It is not expected that there would be a measurable increase in stream temperatures as a result of mechanical and/or hand thinning activities in SEZs. Thinning around meadow edges and in aspen stands would increase the vigor of meadow/riparian vegetation and conserve these landscapes that are important in maintaining highly productive aquatic habitats.

Most streams within the South Shore project area naturally mobilize fine sediment particles during various stages of discharge. These particle sizes are a product of local geology and channel geometric relationships (i.e. width, depth and slope). The highest risk of sediment generation would result from mechanical treatments located in RCAs where reconstruction and/or construction of temporary roads and landings are needed to stage equipment and material. Potential sediment generated from temporary roads and/or landings may result in a decrease of quality spawning sites for fish where small gravels occur, however is not expected to be measurable due to implementation of road BMPs. The highest potential for sediment effects resulting from mechanical treatment in RCAs occur in Saxon Creek, Taylor Creek, Tallac Creek and Upper Truckee River under Alternative 2. Almost all of the needed temporary road crossings will occur over ephemeral tributaries, and reduce the risk for large of amounts of fine sediment delivery. Alternative 2 applies an implementation schedule designed to reduce negative environmental effects and allow for watershed recovery.

Alternative 3

As compared to Alternative 2, the overall acreage of hand thinning units within RCAs and SEZs increases under Alternative 3 due to changes in prescriptions from mechanical to hand treatment. Where mechanical treatments in SEZs have been changed to hand thinning, potential effects on LWD are less than what would be expected in Alternative 2. The amount of potential LWD recruitment in hand thinning units would be greater than what would result from mechanical treatments because hand thinning generally removes fewer trees and is limited to smaller diameter material.

Under Alternative 3, the amount of shade available would be expected to be greater for streams in which mechanical treatment has been replaced by hand thinning. This is due to the retention of more size classes of trees creating a denser canopy cover available to buffer against solar input. No measurable increase in stream temperature is expected to result from either alternative. However, it is expected that riparian shrubs providing a future increase in stream shade and bank stability would increase more slowly under Alternative 3 due to fewer increases in available sunlight.

Alternative 3 reduces the mileage of temporary roads needed, and therefore reduces the potential for sediment effects. The potential for sediment effects from mechanical treatments in RCAs under Alternative 3 would continue for Saxon Creek, Taylor Creek, and Tallac Creek due to the existing road density coupled with temporary roads, landings and stream crossings. Alternative 3 also reduces potential sedimentation by moving all but a few landings out of RCAs, and reducing the number of landings overall. Almost all of the needed temporary road crossings will occur over ephemeral tributaries, and would not be likely to affect aquatic species.

Cumulative Impacts

Past activities within the South Shore analysis area, which have directly affected aquatic habitat include: stream restoration on Angora Creek and Trout Creek, wetland restoration on the Upper Truckee River, and erosion control measures for storm water runoff on state, county and municipal properties. Stream restoration projects have increased the quality of aquatic habitat in the South Shore analysis area. Erosion control projects have attempted to decrease the amount of fine sediment generated from developed lands. Urban lot fuel reduction on Forest Service and California Tahoe Conservancy lands has also occurred to treat fuels on these lots with the exception of management in SEZs. Fuel management on urban lots has not created any measurable amounts of fine sediment input into streams. Larger, healthier trees are usually retained in the urban lots and have contributed to maintenance of stream shade where lots occur adjacent to perennial streams.

The recent Angora Fire resulted in mostly high burn severities along the Angora Creek SEZ and affected stream shade, fine sediment input and local fish populations. A fish kill due to excessive ash deposition was observed immediately post-fire. Effects to aquatic habitat resulting from Angora Fire are currently being monitored by surveying fish populations, measuring stream temperature, assessing macroinvertebrate populations, and monitoring channel conditions. Recent observations indicate that riparian vegetation and brook trout populations are recovering. It is expected that reasonably foreseeable future riparian/wetland restoration projects (channel reconstruction, large wood placement, road/trail BMP improvements and meadow reclamation) will increase the rate of recovery within the Angora Fire.

Future stream and watershed restoration efforts are also expected to occur in the Upper Truckee River, Cold Creek, Angora Creek and Big Meadow Creek. Therefore, aquatic habitat quality (channel stability, pools, LWD and benthic productivity) is expected to increase over the long-term (> 5 years) as stream and watershed restoration efforts continue to move streams, wetlands and meadows to desired conditions within the South Shore project area.

Alternative 1 (No Action)

Under the No Action Alternative, conifer stands within RCAs will remain dense with high fuel loads. Fire model simulations across the South Shore project area showed a distribution of burn severity that indicates a portion of the potential high severity areas would be likely to occur in the

RCAs/SEZs. Impacts could occur to riparian vegetation, which may affect stream channel stability if this vegetation was no longer available to provide bank stability. The effectiveness of stream restoration efforts potentially could be lost were a wildfire to occur.

The past, present, and reasonably foreseeable effects would be expected to occur, however, the No Action Alternative would neither increase nor decrease those effects, and therefore there would be no cumulative effect generated by Alternative 1.

Alternative 2 (Proposed Action)

The Water and Riparian Resources section of this EIS discusses the cumulative watershed effects (CWE) model which was used to assign Threshold of Concern (TOC) values to HUC7 watersheds within the South Shore project analysis area. Values over TOC are presumed to be an issue for aquatic ecosystems if an increase in impervious coverage potentially results in flood events of a higher magnitude that cause undesired stream channel changes (aggradation or degradation). Four of 18 HUC7 watersheds analyzed exhibit values over the TOC before proposed South Shore project treatments are applied and will remain above TOC regardless of whether Alternative 2 treatments occur or not. Disturbance from municipal/urban developed areas is the primary cause of exceeding the TOC in three of the four watersheds. The 4th watershed over TOC is Angora Creek, resulting from the 2007 Angora Fire. Two watersheds experience an increase in risk ratio of more than 20% as a result of Alternative 2 treatments (Tallac Creek=25.7% and Taylor Creek=25.2%). Because these six watersheds would have an elevated risk for cumulative watershed effects, they would also have an elevated risk of negative effects to aquatic habitats and the species occupying aquatic habitats. Treatments under Alternative 2 do not move ERA over the TOC in the other 12 HUC7 watersheds, and therefore negative effects to aquatic species and their habitats are expected to be minimal.

By decreasing the amount of combustible fuels within RCAs, the potential for future effects that are similar to the Angora Fire effects on aquatic habitats would decrease for all 18 HUC7 watersheds within the South Shore project area where treatments are implemented.

Stream and watershed restoration efforts are also expected to occur in the Upper Truckee River, Cold Creek, Angora Creek and Big Meadow Creek. Therefore, aquatic habitat quality (channel stability, pools, LWD and benthic productivity) is expected to increase over the long-term (> 5 years) as stream and watershed restoration efforts continue. In combination with South Shore project fuel reduction activities, ongoing watershed and stream restoration is anticipated to move streams, wetlands and meadows toward desired conditions within the South Shore project area.

Alternative 3

Under Alternative 3, the CWE model shows similar results to Alternative 2 for two groups of HUC7watersheds; 1) watersheds over TOC before fuel treatments are applied and 2) watersheds where values remain under TOC after applying treatments. However, Alternative 3 adjustments in treatment types within the Taylor Creek and Tallac Creek watersheds show reductions in the risk ratio’s to below a 20% increase due to fuels treatments. Alternative 3 reduces the potential for undesired channel changes from increased peak flows in Taylor and Tallac Creeks, which also reduces the potential for negative effects to aquatic species habitat.

Past, present, and reasonably foreseeable activities remain the same under Alternative 3 as under Alternative 2. Stream restoration projects have increased the quality of aquatic habitat in the South Shore analysis area. Erosion control projects have been implemented to decrease the amount of fine sediment generated from developed lands. Urban lot fuel reduction on Forest Service and California Tahoe Conservancy lands has occurred. Urban lot activities and effects under Alternative 3 are the same as Alternative 2, with the same effects to aquatic habitats.

The amount of combustible fuels within RCAs would decrease somewhat less for Alternative 3 than under Alternative 2 due to the change from mechanical to hand treatments in some units. This treatment change may lead to a slight increase in the potential for future cumulative effects on aquatic habitats resulting from wildfire within the South Shore project area.

Future foreseeable actions of stream and watershed restoration would be the same for Alternative 3 as discussed above for Alternative 2. The emphasis on watershed restoration aquatic habitat quality (water quality, channel stability, pools, LWD and benthic productivity) is expected to increase over the long-term (> 5 years) for land management agencies in the Lake Tahoe Basin under Alternative 3. Fuels treatments under Alternative 3 would allow streams to be more resilient to wildfire and would contribute positively as stream and watershed restoration efforts continue to move streams, wetlands and meadows toward desired aquatic habitat conditions within the South Shore project area.

Species-Specific Effects of the Project Alternatives

Lahontan Cutthroat Trout

Alternative 1 – No Action

Direct and Indirect Effects: Under Alternative 1 riparian vegetation conditions will continue to have excessive fuel loadings. Fire behavior models predict an active fire that consumes most of the ground fuels and moves through tree canopies for a wildfire occurring along the Upper Truckee River and around Fallen Leaf Lake. Any LCT residing in the Upper Truckee River where high burn severities are likely to occur may succumb to mortality if ash deposition is at levels that impede respiration. Other factors which could affect LCT would occur from suppression activities (application of retardant or foams) in or adjacent to the Upper Truckee River as well as an interim loss of aquatic habitat elements (i.e. LWD, pools, etc.) over a period ranging from 2 – 7 years.

Potentially high severity fire effects occurring adjacent to Fallen Leaf Lake would not be likely to lead to LCT mortality. This is due to the ability of the fish to escape to other areas of Fallen Leaf Lake.

Cumulative effects: As previously stated, if/when a wildfire occurs there are potential effects of mortality to riparian vegetation in high severity areas. Future stream restoration projects in the Upper Truckee River will have beneficial effects to LCT; however competition with non-native trout would continue to be a limiting factor for population growth. Recovery efforts for LCT in Fallen Leaf Lake are projected to continue (i.e. stocking, non-native fish removal, etc.) and would offset wildfire effects on the population. Under the No Action alternative, the South Shore project would not reduce the risk for high severity wildfire effects to LCT. The past, present, and reasonably foreseeable effects would be expected to occur, however, the No Action Alternative would neither increase nor decrease those effects, and therefore there would be no cumulative effect generated by Alternative 1.

Alternative 2- Proposed Action

Direct and Indirect Effects: Alternative 2 proposes 143 acres of hand thinning in an LCT CAR along a 1 mile section of the Upper Truckee River, while Alternative 3 proposes 82 acres within the same stream corridor. From the Upper Truckee River/Big Meadow Creek confluence to the lower highway 50 crossing there are approximately 59 acres of mechanical and 13 acres of hand thinning units along the Upper Truckee River SEZ. Any potential effect on LCT individuals would be incidental harassment during hand and/or mechanized fuel treatment activities. However, the potential for harassment would be low as the numbers of LCT individuals are expected to be very low. Mortality to LCT individuals would not occur as a result of fuel treatment activities. The overall aquatic habitat integrity would be maintained both during and immediately after fuels treatment.

Recovery efforts for LCT in Fallen Leaf Lake to date have been the experimental stocking of Pilot Peak strains and researching interactions between the species and introduced trout. Research to-date has shown that juvenile LCT stocked into the lake succumb to predation by lake trout and brown trout. One of the primary recommendations from this research is to increase the stocking length of individuals to 10 inches from fry (2-4 inches) in order to avoid predation. Glen Alpine Creek is the only perennial tributary contributing flow to Fallen Leaf Lake and is the only spawning opportunity that would be available for LCT.

There are 7 mechanical treatment units and 1 hand treatment unit adjacent to Fallen Leaf Lake. Four hand treatment units occur adjacent to the Glen Alpine Creek SEZ. Due to the long-term LCT recovery strategy in Fallen Leaf Lake and the lack of a facility to produce 10 inch fish prior to stocking it is not expected that the species will be present during implementation activities. Hand thinning units are not expected to have measurable effects on existing aquatic habitat parameters such as sedimentation. The overall aquatic habitat integrity (lake and stream) would be maintained both during and immediately after fuels treatment.

Cumulative Effects: By decreasing the amount of combustible fuels within Upper Truckee River RCAs/SEZs as part of the South Shore project the potential for future effects on LCT resulting from wildfire would decrease. The effects from Angora Fire involving sedimentation would not affect aquatic habitat in the Upper Truckee River. Stream restoration efforts have occurred in Angora Creek since 2001 and have increased the amount and vigor of riparian/meadow vegetation throughout Washoe Meadows. Therefore, lower Angora Creek would provide a sufficient buffer to the Upper Truckee River and Lake Tahoe for mobilized sediment produced from the fire.

Lahontan cutthroat trout habitat reclamation will occur in the Upper Truckee River below Meiss Meadows and involve manual methods to remove brook trout from 10 miles of stream and 85 acres of lake systems. The purpose is to expand upon the current LCT population in the Upper Truckee River and provide a more robust source population for downstream segments and Lake Tahoe. The TBRIT will also continue to plan and implement recovery activities in Fallen Leaf Lake. It is estimated that recovery actions in Fallen Leaf Lake may include stocking larger size LCT (10 inches or greater), adjusting harvest regulations, and manually removing non-native fish.

Stream and watershed restoration efforts are also expected to occur in the Upper Truckee River as well as tributaries including Cold Creek, Angora Creek and Big Meadow Creek. Therefore, aquatic habitat quality for LCT (channel stability, pools, LWD and benthic productivity) is expected to increase over the long-term (> 5 years) as stream and watershed restoration efforts continue to move streams, wetlands and meadows toward desired conditions within the South Shore project area.

When considering effects from past, present and future foreseeable actions and Alternative 2, LCT populations in the Upper Truckee River and Fallen Leaf Lake are expected to continue to expand in size and distribution. However, competition with non-native trout would continue to be a limiting factor of population growth. Any localized effects, such as sedimentation, from Alternative 2 in the Upper Truckee River and Fallen Leaf Lake would be offset by physical habitat and biological restoration that is expected to occur over the next 5 – 10 years.

Alternative 3

Direct and Indirect Effects: Alternative 3 reduces hand thinning in the LCT CAR along a 1 mile section of the Upper Truckee River. From the Upper Truckee River/Big Meadow Creek confluence to the lower highway 50 crossing Alternative 3 reduces mechanical thinning and increases hand thinning along the Upper Truckee River SEZ. Any potential effect on LCT individuals would be incidental harassment during hand and/or mechanized fuel treatment activities. The potential for harassment would be low as LCT individual occurrences are expected to be very low. Mortality to LCT individuals would not occur as a result of fuel treatment activities. The overall aquatic habitat integrity would be maintained both during and immediately after fuels treatment.

The 7 mechanical units and 1 hand treatment unit adjacent to Fallen Leaf Lake and 4 hand treatment units adjacent to the Glen Alpine Creek SEZ remain unchanged from Alternative 2. However, the potential for sedimentation impacts from Alternative 3 is less due to changes in the type of mechanical treatments and the application of lake buffers. Hand thinning units are not expected to have measurable sediment effects on existing aquatic habitat. The overall aquatic habitat integrity (lake and stream) would be maintained both during and immediately after fuels treatment to a slightly higher degree than Alternative 2.

Cumulative Effects: By decreasing the amount of combustible fuels within Upper Truckee River RCAs/SEZs the potential for future effects on LCT resulting from wildfire under Alternative 3 would decrease. Alternative 3 proposes less mechanical fuel treatment in RCAs/SEZs and implements additional vegetation design criteria beneficial to aquatic habitats compared to Alternative 2.

The effects from Angora Fire and Lahontan cutthroat trout habitat reclamation would remain the same as Alternative 2. Stream and watershed restoration efforts are also expected to occur and improve aquatic habitat quality for LCT (channel stability, pools, LWD and benthic productivity) over the long-term (> 5 years) as discussed under Alternative 2. When considering effects from past, present and future foreseeable actions with Alternative 3, LCT populations in the Upper Truckee River and Fallen Leaf Lake are expected to continue to expand in size and distribution. However, competition with non-native trout would continue to be a limiting factor of population growth. Any localized effects, such as sedimentation, from Alternative 3 in the Upper Truckee River and Fallen Leaf Lake would be offset as physical habitat and biological restoration is expected to occur over the next 5-10 years.

Lahontan Lake tui chub and Great Basin rams-horn

Alternative 1 – No Action

Direct and Indirect Effects: Under Alternative 1 riparian vegetation conditions will continue to have excessive fuel loadings. The No Action Alternative would not reduce these fuel loads.

Fire models predict an active fire that consumes most of the ground fuels and moves through tree canopies if a wildfire were to occur along lower sections of the Upper Truckee River, Taylor Creek, Tallac Creek and Trout Creek. In the event that tui chub and/or Great Basin rams-horn are residing in these lower gradient/shore zone tributary reaches in the south shore area, mortality to individuals could occur from excessive ash deposits in the water column and fire suppression actions such as the application of retardant or foams. The interim loss of aquatic habitat elements caused by wildfire is likely to last over a period ranging from 2 – 7 years. However, recent surveys in the project area where adequate habitat exists have not detected tui chub and/or Great Basin rams-horn. Therefore, any mortality or localized individual displacement from a potential wildfire will not change the overall range-wide population status of the species.

Cumulative effects: Although past, present and future stream restoration will improve tui chub and Great Basin rams-horn habitat conditions, the presence of invasive non-native largemouth bass and *Corbicula* (Asian clam) will continue to be primary limiting factors to population growth.

The past, present, and reasonably foreseeable effects would be expected to occur, however, the No Action Alternative would neither increase nor decrease those effects, and therefore there would be no cumulative effect generated by Alternative 1.

Alternative 2

Direct and Indirect Effects: Fish surveys conducted in the Upper Truckee River (Sunset Reach) did not detect Lahontan Lake tui chub nor Great Basin rams-horn within the South Shore project area. Surveys covered the Sunset Reach and species distribution is unknown in other lower gradient/basin reaches of Trout Creek, Tallac Creek, Taylor Creek and Upper Truckee River. Both tui chub and Great Basin rams-horn prefer lower gradient stream and shore zone aquatic habitats.

Alternative 2 proposes both mechanical treatment units and hand thinning unit within the Taylor/Tallac/Upper Truckee River marsh area (north of highway 89 and 50). A number of the units in the Taylor/Tallac/Upper Truckee River marsh area have objectives of reclaiming wet meadow habitats from encroaching conifers. The objective of maintaining meadow integrity is consistent with achieving channel form and function, which is important to tui chub and Great Basin rams-horn habitats.

The mechanical and hand thinning units along the Upper Truckee River SEZ in Alternative 2 are not expected to cause any mortality to tui chub individuals which are potentially residing in the project area. Disruption to tui chub behavior from fuel removal activities may occur at very low frequencies due to the potential for low number of individuals to reside in the project area at any given time. Overall habitat integrity is expected to be maintained in the Upper Truckee River.

Lahontan tui chub are known to occur in Fallen Leaf Lake. Under Alternative 2 there are 7 mechanical treatment units and 1 hand treatment unit adjacent to Fallen Leaf Lake. Because tui chub normally reside at depths greater than 5 feet in Fallen Leaf Lake it not expected that fuel reduction activities will have impacts the species behavior or cause mortality to individuals.

Cumulative Effects: Prior to large-scale stocking of non-native salmonids and illegal introduction of warm-water fishes its likely that tui chub occupied most lower gradient habitats in the south shore. Introduced game fishes compete with Tui chub for food and cover and Tui chub have become a prey species within this altered ecology. Due to low detection of tui chub throughout South Shore project tributaries it is likely that non-native fish introductions have had adverse impacts on the population.

Urbanization associated impacts (i.e. channelization of streams, dredging of the Tahoe Keys) and impacts from introduced non-native aquatic species have altered native mollusk habitat. It is not known if any of these impacts have led to local extirpation of Great Basin rams-horn from the south shore and throughout Lake Tahoe Basin. The greatest threat to native mollusks in Lake Tahoe Basin are from invasive mussels, such as quagga mussel (*Dreissena rostrifomis bugensis*), zebra mussel (*Dreissena polymorpha*) and New Zealand mudsnail (*Potamopyrgus antipodarum*). The recent discovery of invasive *Corbicula* (asian clam) is currently being researched to understand impacts to the aquatic ecosystem, however undoubtedly the species will complete for resources with native mollusks.

The future persistence of both tui chub and native mollusks will be influenced by fisheries management practices (i.e. fish removal/adjustments in non-native trout harvest regulations for LCT conservation), prevention of future non-native aquatic species invasions and continued watershed/stream restoration efforts. Tui chub and native mollusk habitat is expected to be enhanced over the long-term (> 5 years) when considering fuels reduction in SEZs/RCAs from Alternative 2 in combination with future stream restoration projects.

Alternative 3

Direct and Indirect Effects: Alternative 3 proposes the same mechanical treatment units and hand thinning units within the Taylor/Tallac/Upper Truckee River marsh area (north of highway 89 and 50) as Alternative 2. The objectives of reclaiming wet meadow habitats from encroaching conifers in number of the units in the Taylor/Tallac/Upper Truckee River marsh area remain the same as Alternative 2, and are consistent with achieving channel form and function important to tui chub and Great Basin rams-horn habitats.

The mechanical and hand thinning units along the Upper Truckee River SEZ in Alternative 3 are not expected to cause any mortality to tui chub individuals which potentially reside in the project area. Disruption to tui chub behavior from fuel removal activities may occur at very low frequencies due to the low potential for individuals to reside in the project area at any given time. Overall habitat integrity is expected to be maintained in the Upper Truckee River.

Lahontan tui chub are known to occur in Fallen Leaf Lake. Under Alternative 3 the same mechanical and hand treatment units would be implemented adjacent to Fallen Leaf Lake. Because tui chub normally reside at depths greater than 5 feet in Fallen Leaf Lake it not expected that Alternative 3 fuel reduction activities will have impacts to the species behavior or cause mortality to individuals.

Cumulative Effects: There are no measurable cumulative effects to Tui chub and Great Basin rams-horn for Alternative 3 and Alternative 2. Tui chub and native mollusk habitat is expected to be enhanced over the long-term (> 5 years) when considering fuels reduction in SEZs/RCAs from Alternative 3 in combination with future stream restoration projects.

Determinations

The determinations follow the guidelines and definitions established by the Pacific Southwest Region of the Forest Service (USDA 1996 and USDA 2000) for sensitive species and are described in brief next.

- Determinations of “no effect” are usually appropriate only if the project is not located in (or does not affect) suitable or critical habitat and if disturbance or other direct or indirect impacts to the species are not an issue. Projects within suitable or critical habitat must demonstrate that there are no direct or indirect impacts to the species or its habitat to support a “no effect” determination. “No effect” determinations are unusual if suitable habitat for a species is in any way entered or otherwise affected.
- Determinations of “not likely to adversely affect” are usually appropriate when the project occurs in (or affects) suitable or critical habitat or results in disturbance to the species, but take criteria (e.g., quantity or quality of habitat, disturbance, etc.), recovery plan objectives, or regional aquatic conservation strategies are clearly met.
- Determinations of “not likely to lead to a trend toward federal listing” are usually appropriate when the project occurs in (or affects) suitable habitat or results in disturbance to the species, but compliance with any existing terrestrial or aquatic conservation strategies can be shown.
- Determinations of “likely to lead to a trend toward federal listing” are usually appropriate when the project occurs in (or affects) suitable habitat or results in disturbance to the species, and compliance with existing conservation strategies can not be demonstrated.

Based on the description of the proposed alternatives and the analysis considered, the following determinations were found:

- The South Shore project **may affect, but is not likely adversely affect** the Lahontan Cutthroat trout for Alternatives 1, 2, and 3.
- The South Shore project DEIS may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability of Lahontan Lake tui chub for Alternatives 1, 2, and 3.
- The South Shore project will **not affect** the Great Basin rams-horn for Alternatives 1, 2, and 3.
- The South Shore project will **not affect** the Delta smelt, mountain yellow-legged frog, Yosemite toad, or the northern leopard frog for Alternatives 1, 2, and 3.

Table 3-72. Threatened, Endangered, and Sensitive Species for the LTBMU, and effect determinations for project level analysis for the South Shore project

Species	Special Status	Known to occur in project area	Suitable Habitat in project area	*Determination for Alternatives 1, 2, & 3
Fish				
Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*)	Threatened	Yes	Yes	may affect, but is not likely to adversely affect
Delta smelt (*Hypomesus transpacificus*)	Threatened	No	No	no effect
Lahontan Lake tui chub (*Gila* bicolor *pectinifer*)	Forest Sensitive Species	Yes	Yes	may affect individuals, but is not likely to lead to federal listing or loss of viability
Amphibians				
Mountain yellow-legged frog (*Rana muscosa*)	Candidate; Forest Sensitive Species	No	Yes	no effect
Yosemite toad (*Bufo canorus*)	Candidate	No	Yes	no effect
Northern leopard frog (*Rana pipiens*)	Forest Sensitive Species	No	Yes	no effect
Invertebrates				
Great Basin rams-horn (*Helisoma newberryi newberryi*)	Forest Sensitive Species	Yes^	Yes	no effect

^suspected to occur

F. Terrestrial Wildlife

In order to avoid repetitive text, the overall existing conditions for wildlife habitats and the effects of the alternatives to those habitat conditions will be discussed first, followed by discussions specific to individual species.

Scope of the Analysis, Indicators, and Concerns

None of the species discussed in this Terrestrial Wildlife section required consultation with the USFWS. Species considered are based on the January 31, 2008 (verified on October 14, 2008) list of federally threatened, endangered, proposed, and candidate species for the Lake Tahoe Basin Management Unit (LTBMU) from the USDI Fish and Wildlife Service (USFWS; http://sacramento.fws.gov/es/spp_list.htm). The USDA Forest Service's wildlife sensitive species list is based on the Pacific Southwest Region's list of 1998, as amended. These lists are the most current versions for the LTMBU. All applicable standards and guidelines from the LTBMU - LRMP and associated amendments (e.g., USDA FS 2004), and other applicable laws and regulations will be applied to this project. Key standards and guidelines from the Sierra Nevada Forest Plan Amendment (USDA FS SNFPA 2004) and land management practices from the Lake Tahoe Basin Management Unit, Land and Resource Management Plan (LRMP, 1988) for terrestrial wildlife species and habitats are summarized in the Terrestrial Wildlife BE/BA located in the project file.

For the analysis of wildlife existing conditions and effects, the South Shore project area is defined as the area where the vegetation treatments would occur under the action alternatives. The wildlife analysis area includes the project area and associated hydrologic unit code seven (HUC7) watersheds, plus the Echo Lake, California spotted owl PAC and home range core area (HRCA), and the Tahoe Regional Planning Agency bald eagle winter habitat mapped between Emerald Bay and Taylor Creek, California (Map 17). The wildlife analysis is temporally defined to extend 15 years before and after the present; in correlation with the estimated longevity of the majority of forest vegetation treatments.

Delineation of the wildlife analysis area is based upon potential direct, indirect, and cumulative effects of the proposed action on terrestrial threatened, endangered, proposed, candidate, and sensitive (TES) species and their habitats within and overlapping the analysis area. The Echo Lake spotted owl PAC (300 acres) and HRCA (1,000 acres), which are mapped across LTBMU and Eldorado National Forest boundaries, are included in the wildlife analysis area because they overlap the analysis area (90 acres and 196 acres, respectively) and areas where project implementation may occur (up to 58 acres and 144 acres, respectively). The bald eagle winter habitat mapped by TRPA between Emerald Bay and Taylor Creek (2,473 acres) is included in the wildlife analysis area because it overlaps the analysis area (1,218 acres) and forested stands where project implementation may occur (up to 162 acres).

The existing condition of forest vegetation and the changes that would likely occur as a result of the proposed alternatives, as they relate to wildlife habitat suitability, are quantified using the California Wildlife Habitats Relationships (CWHR) computer program developed by California Department of Fish and Game (2005). The CWHR program describes vegetation conditions through metrics such as tree size classes and canopy closure and functions as a predictive model of habitat suitability for wildlife species. Habitat suitability within each vegetation type is ranked as 0.0 (not suitable), 0.33 (low), 0.66 (moderate), or 1.0 (highly suitable) for each wildlife species. Changes in vegetation condition are therefore correlated to changes in habitat suitability. This correlation provides a useful tool to estimate the direction and magnitude of changes in wildlife habitat suitability caused by changes in vegetation condition.

Life history requirements and species-specific habitat relationships are described for each species analyzed. Impacts that would result from mechanical thinning (and other treatment types) are interpreted and quantified by predicted changes in the number of acres of CWHR size and density classes available that represent high and moderate capability habitats, unless otherwise described. These predicted changes in stand conditions are displayed for reproductive, cover, and foraging habitats for each species in the species-specific analyses.

CWHR does not provide a useful estimate of habitat suitability for all wildlife species (e.g., Townsend's big-eared bat and willow flycatcher). Habitat use and suitability for Townsend's big-eared bat, for example, are dependent on site-specific conditions (i.e., related to a cave or cave-analogue) and not meaningfully described in terms of acres. In these unusual cases, a surrogate method of estimating existing habitat and changes to that habitat that would likely occur as a result of the action alternatives is described in the section for individual species.

The Forest conducts willow flycatcher, wetland bird, and/or fish and invertebrate species surveys in these habitats annually. Data collected during the 2008 field season was reported in the Terrestrial Wildlife BE/BA for the South Shore project EIS. The Forest also recently completed multi-Species inventory and monitoring (MSIM) project surveys, which surveyed several suites of wildlife and botany communities during a four-year period (unpubl. data 2001-02, 2004-05). The results of these survey efforts have been used to assist in designing the location, extent, timing, and prescription of vegetative treatments proposed by the Forest and may be used in monitoring the response to the treatments.

Existing Conditions

The wildlife analysis area is approximately 86,790 acres, of which 70,581 acres (81.3%) are National Forest System lands. Elevations range from 6,230 feet to 8,159 feet within the project area and 5,322 feet to 10,881 feet within the wildlife analysis area. Dominant plant communities providing wildlife habitat within both the project and wildlife analysis areas include lodgepole pine, sierran mixed conifer, Jeffrey pine, montane chaparral, and red fir associations.

Existing conditions for these plant communities in the wildlife analysis area have been influenced by major historic land uses and practices such as Comstock era logging (1860-1920), cattle and sheep grazing (1850's-1950's), rapid human development (1960-1980), and fire suppression throughout urbanization of the basin (1911-present). Climate change may also be affecting existing conditions. As a result, the density, structure, composition, and distribution of vegetation within the wildlife analysis area have been altered and are likely outside the range of natural variability in the most affected areas. The desired condition of more than one canopy layer is often absent in the project area. Connectivity between early seral or lower canopy habitats and upper canopy habitats is generally lacking within Comstock-era, second growth, even aged, densely stocked stands. Please refer to the Vegetation section for a more detailed discussion of the existing conditions of vegetation within the project analysis area. The existing condition of vegetation has implications on the biological integrity of the wildlife analysis area. Because the historic ecosystem within the area analyzed was adapted to a variety of naturally-occurring wildland fire regimes, the current ecosystem is presumed to be functioning sub-optimally and is at greater risk of damage from a wildland fire.

The South Shore project area also contains aquatic, riparian, and meadow ecosystem habitats. Most of the streamside environment zones (SEZs) in the proposed action area are currently substantially overstocked due to a long history of fire suppression (since 1911) in the Lake Tahoe basin and because the SEZs were frequently avoided during fuels treatments over the past several decades. Biological productivity in many of these overstocked areas is likely suppressed and not within the natural range of variability.

Examples of this sub-optimal ecological function include, but are not limited to, fuel-choked riparian corridors and conifer-encroached aspen stands, both identified as biologically diverse ecosystem types in the Lake Tahoe basin (USDA FS 2000). Fuel densities within some of the riparian corridors are adversely affecting riparian shrub survival and regeneration, understory vegetation structure and composition, and hydrologic stability and function. These in turn are adversely affecting the composition, species-richness, and abundance of the wildlife communities that utilize riparian habitats by reducing available riparian shrub nesting or foraging habitat. Similarly, conifer-encroachment of aspen stands is adversely affecting aspen survival and regeneration, availability and elevation of local water tables, understory plant communities, and, therefore, wildlife community composition, species-richness, and abundance.

The existing risk of wildland fire in the analysis area was demonstrated by the effects of The Angora Fire (2007). Wildlife habitats would likely be adversely affected if a wildland fire occurred in the wildlife analysis area; however, this analysis does not assume there would be a wildland fire. Please refer to the fire and fuels section for a more detailed discussion of fire within the project analysis area.

Direct and Indirect Environmental Consequences

In order to avoid repetitive text, the overall wildlife habitat effects of the alternatives will be discussed first, followed by the discussions specific to individual species habitat conditions and effects.

Alternative 1 (No Action)

Under the No Action alternative, current management plans, especially the SNFPA decision to emphasize reduction of hazardous fuels in wildland urban intermix areas, would not be implemented. Current conditions in the wildlife analysis area would continue, and the existing risk of wildland fire in the analysis area would continue. There would be no direct or indirect effects from implementation of the No Action alternative.

Alternative 2 (Proposed Action)

Alternative 2 would improve forest health and reduce hazards to residences and other resources at risk, including wildlife and their habitats, from wildland fire by creating defensible space around communities within the WUI on forest system lands. Effects to wildlife may occur on or adjacent to treatment areas, including non-forest system lands as the home ranges of wildlife often cross over ownership boundaries within the wildlife analysis area. The fact that thinning treatments would occur within the WUI would moderate the potential to affect listed species because habitats within the WUI are often less suitable than equivalent habitats located outside the WUI due to the amount of human disturbance. Exceptions exist for some of the listed species and are discussed in the species-specific analyses.

In Alternative 2, forest health and hazardous fuels would be addressed with consideration for wildlife resources. All California spotted owl PACs would receive specialized thinning prescriptions to preserve habitat suitability for this species. All goshawk PACs and stands within TRPA goshawk nest disturbance zones would receive specialized thinning prescriptions to preserve habitat suitability for this species. Reductions in basal area are expected to affect canopy cover and would remove live, infested, diseased, and dead trees. Standing (snags) and down dead (coarse woody debris, CWD) trees would be removed to achieve a mean residual surface fuel load of 5 to 15 tons per acre in treatment areas. Residual snag and CWD retention is expected to provide suitable habitats for listed species where existing mean snag density is equivalent to or greater than the desired condition.

Proposed treatments are expected to increase radial and lateral growth, increase tree species diversity, improve canopy structure and stand resistance to drought, insects, disease, and fire. Increasing radial and lateral growth would benefit wildlife by providing greater cover and connectivity between early seral or lower canopy habitats and upper canopy habitats. Establishing a trend toward more than one canopy layer is expected to move treated stands toward the natural range of variability and benefit listed wildlife species.

To provide refuge for wildlife during implementation and minimize the level of effects to wildlife in any given year, vegetation treatments where treatment stands are located in close proximity to one another would be scheduled over time where possible, rather than treated all together. With the exception of over-snow operations carried out during pre-dawn hours when soils and snow pack are most likely to be sufficiently frozen, project implementation would occur during the daytime, predisposing direct effects to wildlife to occur during the daytime.

Thinning

Proposed thinning treatments are expected to remain effective for 15-20 years. During that time, increases in stand density and accumulation of fuels are expected to occur. Further treatments will be required an estimated 15-20 years in the future, depending on site productivity, when the proposed treatments are determined to no longer be effective (i.e., stand densities and fuel loads exceed the range of desired conditions). The Proposed Action is expected to affect wildlife and their habitats during implementation and during the lifetime of the treatments for each type of primary and follow-up treatment.

Thinning prescriptions for each stand determine post-implementation forest structure, and the resulting forest structure is expected to determine the effect on wildlife, rather than the method of implementation (information on methods i.e., hand or mechanical thinning, is found in the vegetation section of this document). The discussion in this section is limited to effects for terrestrial wildlife, especially TES species.

The removal of understory trees, particularly trees smaller than 6 inches dbh, would generally result in little or no impact to existing canopy closures. The removal of trees smaller than 6 inches dbh would affect canopy closure when little or no overstory canopy exists, as is found in early seral, high stem-density, even-aged conditions. Removal of mid-story trees would generally reduce canopy cover and occasionally cause an increase in the predicted post-treatment CWHR size class as mean tree size increases following the removal of smaller size class trees. This type of change in predicted CWHR size class represents an increase in residual mean stem diameter, rather than physical growth of the stand.

An increase in the amount of open space present below the overstory canopy would also occur as trees are thinned from the understory and mid-story. Reduced overall canopy cover and wider crown spacing would result where overstory trees up to 30 inches dbh are thinned to meet healthy forest and fuel hazard objectives or as needed for equipment operability. The effect of predicted changes in CWHR size and density classes and related changes in forest structure on each of the species analyzed in this document depends upon species-specific habitat requirements, and is discussed by the individual species.

Final stand structure does not differ by type of operation, whether cut-to-length or whole tree, but final stand ground cover (e.g., partially covered by chipped, masticated, or lopped-and-scattered material) does differ. Residual processed materials impact soil temperature, humidity, erosion potential and herbaceous and shrub recovery rates, which indirectly affect prey species. Chipping and masticating to an average maximum depth of six inches would generally result in short term (i.e., one to five year) reductions in post-treatment herbaceous and shrub recovery and, therefore, result in commensurate reductions in the abundance of prey species dependent on such vegetation for forage or cover. General effects to the wildlife species analyzed, which are predators, would be moderated by their ability to forage over relatively large home ranges, including untreated areas located within or outside the WUI. Lopped-and-scattered residual thinning materials would marginally reduce herbaceous and shrub recovery rates over the short term, but would immediately increase cover for prey species during the same period. The potential effects of landing pile burning are limited because this type of follow-up treatment activity would occur over a limited proportion (approximately 2 percent) of the treated area. Short term disturbance related to landing pile burning would include alteration in the spatial distribution of individuals or habitat use patterns, but would be expected to end following implementation.

Prescribed fire is generally beneficial to wildlife species following the initial disturbance of implementation. The heat and flames of prescribed fires would be unlikely to lead to mortality of individuals of the species analyzed because of their ability to move out of affected areas and avoid these threats. Implementation of limited operating periods (LOPs) would minimize the potential risk to reproductive success for these species because prescribed burning would not occur near known reproductive sites (e.g., nest trees) of the analyzed wildlife species during the reproductive season. In the unlikely case that prescribed burning occurred in locations of undiscovered reproduction of these species, it would lower the probability of survival of individual animals at affected nest sites. Reproductive adults and independent offspring would likely survive a prescribed burn given the relatively slow moving nature of the treatment compared to their ability to escape the area. Dependent offspring, especially those not able to escape the area, would likely be at risk depending on their location and exposure to the prescribed burn.

After the implementation of Alternative 2, herbaceous, shrub, and understory forest recovery rates, species richness, and diversity would generally be improved in the treatment units. These benefits to the vegetation community are generally transferred, and occur slightly later in time, upward through the trophic levels of an ecosystem, moderating through each step.

Thinning operations would differ between uplands and stream environment zones (SEZs) in the follow-up treatments implemented. The structure, composition, and diversity of the herbaceous and shrub communities, especially the riparian shrub community (e.g., willows, alders, and other large deciduous shrub-form vegetation), in these SEZs are expected to benefit substantially from the proposed action in the short and long term. Riparian shrubs are likely to re-colonize treated segments of the SEZs. Forest structure in the SEZs is also expected to be positively affected as competition from conifers is reduced and shading by dead standing materials is reduced. Implementation of Alternative 2 is expected to result in the establishment of early seral cohorts and improvement in the health of mature trees. Re-colonization and rejuvenation of stream environment zone vegetation is expected to provide substantial long and short term ecosystem benefits (e.g., increased abundance, species-richness, cover, and resilience to invasion by non-native species) within and adjacent to treated stands. Given the existing condition of SEZs in the proposed action area, the long term benefits to wildlife within these SEZs are expected to substantially outweigh the potential short term impacts of implementation. The anticipated effects of fuel reduction treatments on wildlife in SEZs are generally greater than those on wildlife in uplands because wildlife species-richness and abundance are typically greater in SEZs than in uplands.

Reforestation

Reforestation would occur on a small scale, in limited portions of the project area. The effect of reforestation on wildlife is expected to be minimal to negligible. Some disturbance to individual animals (e.g., causing an individual to leave the area and temporarily alter habitat use patterns) may occur during planting, watering, or monitoring activities. No mortality or loss in reproduction would be expected. Reforestation would be expected to result in minor long term benefits to wildlife species as early seral stages mature and provide additional foraging habitat.

Brushing

Like reforestation, brushing would occur on a small scale, in limited portions of the project area. The effect of brushing on wildlife, given project design features for the protection of known reproductive sites during the breeding season, is expected to be minimal to negligible. Some disturbance to individual animals (e.g., causing an individual to leave the area) may occur during implementation. The availability of prey species that utilize brush habitats for reproduction, cover, or foraging may be reduced temporarily and commensurately with the reduction in brush habitat. Prey availability would be expected to recover as the habitat matured. If species composition were altered from brush to tree species then small scale, long term changes in habitat use patterns may occur. No mortality or loss in reproduction for the analyzed wildlife species is anticipated.

Meadows and Aspen Stands

Conifer removal from meadows is expected to increase deciduous riparian and herbaceous vegetation species-richness, diversity, abundance, and spatial extent. Thinning conifers from meadows is expected to cause visual and audible disturbances during implementation, more often affecting forest edge and meadow associated wildlife species. These disturbances would be expected to temporarily alter habitat use patterns, unless otherwise described in the species-specific analyses below. Meadows often attract a diversity of wildlife species, contributing to the health of the local ecosystem as a whole. Removing conifers from meadows is expected to enhance the persistence and function of meadow habitats, and wildlife are expected to experience long term benefits (e.g., increased productivity, prey availability, and foraging habitat) from the Proposed Action. Prescribed burning in meadows would have similar effects to prescribed fire following other types of thinning operations (as described above), but would be likely to affect forest edge and meadow associated wildlife species rather than forest interior associated species.

Aspen are fire-adapted and would benefit from conifer removal, especially after decades of fire suppression activities in the Lake Tahoe basin. Aspen are also a focal point of wildlife activity and were identified as an ecologically important ecosystem in the Lake Tahoe Watershed Assessment (USDA FS 2000). Aspen add diversity and spatial variability to forest and wildlife community composition, but constitute less than two percent of the forested area on the LTBMU. Conifer removal from aspen stands will reduce shading of existing aspen, increase sunlight penetration to the forest floor, increase soil temperatures, stimulate aspen root systems, and result in increased aspen stand growth, vigor, regeneration, function, and persistence on the landscape. As aspen stands are also resistant to fire, the removal of conifers from aspen stands will contribute to the resilience of this forest type to wildland fires and likely reduce overall wildland fire behavior. Conifer thinning from aspen stands would effect wildlife in the short term as described in general above (e.g., temporary disturbance during implementation), unless otherwise described in the species-specific analyses below. Long term effects are expected to include increased ecosystem productivity, prey availability, foraging habitat, and provide refuge areas from wildland fire.

Roads and Landings

The general effect of roads on wildlife is to increase habitat fragmentation and increase edge habitat, and the magnitude of that effect is determined by the location of the road and the context of land use in that location. Use of existing permanent roads is unlikely to affect listed wildlife species when project-related use is equal to or less than the background level of road use; otherwise effects (e.g., altered animal behavior arising from visual or audible stimuli) may occur commensurate with the degree of project use above the background use level. Use of temporary roads would have greater potential to effect on TES wildlife species because the background level of disturbance on and adjacent to temporary roads is generally lower than that for permanent roads. The use of existing temporary roads would require reconstruction when the existing condition is insufficient to meet project needs, which could cause disturbance commensurate with the level of reconstruction required. For example, minimal road surface reparation on a temporary road currently used as a popular, single-track recreation route – a fairly common occurrence on the LTBMU – would cause less potential disturbance than reconstruction of a temporary road that was effectively decommissioned and is no longer being used, because the potential effects are related to the work implemented (e.g., simple versus moderately intensive road surface clearing) and the context of the work (e.g., work in an already urban area compared to work in an area with little or no ongoing human disturbance).

New temporary roads would require construction that differs from road reconstruction primarily by the need to create a corridor through the forest. Temporary road construction, and the removal of trees, has the potential to affect wildlife (e.g., causing them to leave the immediate area and eliminating cover), but to a much lesser degree than the thinning operations the roads would facilitate. Constructing temporary roads would increase the amount of local forest edge habitat, which may be detrimental to forest-interior adapted species (e.g., marten). The intensity of the potential effect would be related to the context of the new road. A new road located in an otherwise un-fragmented patch of forest would have a larger impact than a new road located near an urbanized area with crisscrossing travel routes with negligible effects. Project surveys were conducted to determine sensitive locations (e.g., nest sites) for listed species and assist the Forest in locating new temporary roads in alignments that would minimize the risk of negatively affecting these species. The potential for effects to occur to wildlife related to constructed and reconstructed temporary roads would be expected to decline over time as wildlife adapt to their environment and would continue until road decommissioning occurred. A potential effect of increased edge habitat may linger along the road corridor until the canopy reclaimed the alignment in the long term.

An estimated 219 landings are needed to implement the proposed action; these would be dispersed throughout the mechanical treatment units. The general effect of landings on wildlife is to increase the amount of forest edge habitat and increase the total area and number of forest openings. The magnitude of that effect is determined by the location of the landings and the context of land use in those locations. Use of existing landings is not expected to increase the amount of edge habitat in the project area but could cause disturbance to wildlife as described for temporary roads above. Construction of new landings would indirectly affect wildlife through the creation of edge, early seral, and forest opening habitats. While fewer acres of these habitats currently exist within the analysis area compared to estimated pre-fire suppression era or desired conditions, the construction of landings would not mimic the spatial distribution or extent of natural processes (e.g., wildfires or wind-throw events). Landings may be reclaimed by early seral vegetation following rehabilitation, but because further vegetation management is likely to be required 15-20 years after project completion, it seems reasonable that at least some of the landings associated with this project would be reused in the future.

Alternative 3

In regard to wildlife, Alternative 3 differs from Alternative 2 through changes to treatments designed to reduce impacts to sensitive species and their habitats. Alternative 3 would increase consideration given to wildlife resources in the project area through acres eliminated from treatment or changes from mechanical to hand thinning operations. In Alternative 3, stands or portions of stands would be eliminated from treatment based on the locations of PACs in relation to WUI defense and threat zones and fire behavior predicted using FARSITE, FLAMMAP, and FVS models. Fewer PACs would be treated in Alternative 3. Alternative 3 would also eliminate mechanical treatments in PACs where desired conditions for predicted fire behavior could be met by hand thinning methods. The estimated number of acres that would be treated in Alternative 3 would be less than in Alternative 2, reducing the overall scope of effects. The effects of Alternative 3 to wildlife, by treatment type, differ from those for Alternative 2 as described below and as described in the species-specific analyses.

Thinning

General direct and indirect effects from thinning would be the same in Alternative 3 as in Alternative 2 except that mechanical disturbance effects would occur over approximately 1,581 fewer acres, lessening the scope of effects. The same types of follow-up treatments would occur and the overall spatial distribution of treatments would not change substantially. The general effect to wildlife would be as described for Alternative 2, but with a reduced scope of effects due to the reduced treatment acreage.

A difference in anticipated effects would result from the introduction of a new follow-up treatment: chipping/masticating followed by prescribed fire (i.e., underburning) in approximately 140 acres of hand thinning. The effects to wildlife would be similar to those previously described for chipping/masticating and underburning independently, except that the short term recovery of the herbaceous and shrub components of areas chipped or masticated would be delayed by approximately two years (the time in which the chipped/masticated materials would be allowed to dry and then be burned), followed by the beneficial effects (e.g., increased herbaceous and shrub species-richness and abundance) of prescribed fire. The net effect to wildlife would be an increase in potential disturbance (as two follow-up treatments would be conducted), a two year delay in herbaceous and shrub layer recovery (cover utilized by prey species), and improved ecological function due to the re-introduction of fire into this fire-adapted ecosystem. Chipping and/or masticating followed by prescribed fire would be implemented in about one percent of the treatment area, limiting the scope of effects of this type of follow-up treatment. The effects of other types of follow-up treatments to wildlife are described above (see Alternative 2).

Reforestation

General direct and indirect effects from reforestation would be the same for Alternative 3 as described for Alternative 2 except that the total area treated, and therefore the area in which reforestation could occur, would decrease by approximately five percent, lessening the scope of effects.

Brushing

As for reforestation, general direct and indirect effects from brushing would be the same for Alternative 3 as described for Alternative 2 except that the total area treated, and therefore the area in which brushing could occur, would decrease by approximately five percent, lessening the scope of effects.

Meadows and Aspen Stands

General direct and indirect effects from treatments in meadows would be the same in Alternative 3 as in Alternative 2 except that effects would occur over approximately 21 fewer acres, lessening the scope of effects. General direct and indirect effects from treatments in aspen stands would be the same in Alternative 3 as in Alternative 2 except that effects would occur over approximately 39 fewer acres, also lessening the scope of effects.

Roads and Landings

As in Alternative 2, most of the proposed project would be accomplished on the existing permanent road system. No new permanent roads would be constructed. In Alternative 3, fewer miles of new temporary roads and existing temporary roads would be constructed or reconstructed. Total temporary roads required would decline by 18 percent in Alternative 3, lessening the scope of effects. Similarly, Alternative 3 would require an estimated 50 fewer landings, also lessening the scope of effects. General direct and indirect effects to wildlife from roads and landings would otherwise be the same for Alternative 3 as described for Alternative 2.

Cumulative Impacts

Cumulative effects represent (40 CFR 1508.7) 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." Appendix A gives a summary of past, present, and reasonably foreseeable projects within the South Shore project analysis area that could contribute to cumulative effects for this project.

Past Actions

Actions that would contribute to a cumulative effect since 1993 (15 years before present) are categorized into vegetation (e.g., forest health and hazardous fuels), restoration (e.g., stream and meadow restorations), and engineering (e.g., roads and trails) projects to facilitate clarity and organization in this analysis. A detailed, multi-agency summary index of past projects (some still ongoing) for the Lake Tahoe basin, is presented and updated by the Lake Tahoe Environmental Improvement Program (EIP), the overarching framework for capital improvement and science or research projects in the Lake Tahoe basin, on the Tahoe Integrated Information Management System (TIIMS) website at http://www.tiims.org/Content/Projects/EIP/default.asp.

Past vegetation projects within the wildlife analysis area treated approximately 11,280 acres. An estimated 5,180 acres of secondary treatments (e.g., chipping, mastication, and burning) have also occurred. The effects of past vegetation projects to wildlife are essentially the same as those described for the proposed action because they include the same types of primary and follow-up treatments, over a similar number of acres (11,282 acres compared to 10,670 acres for the proposed action), and a similar time frame (15 years).

Past restoration projects within the wildlife analysis area have restored approximately 5.4 miles of streams and 146.5 acres of SEZ, floodplain, riparian, and meadow habitats. The effects of past restoration projects to wildlife may be characterized as causing moderate disturbance during implementation, followed by one to five years of slight to moderate beneficial effects while herbaceous and shrub vegetation recovers, and then several to many years of moderate to substantial beneficial effects as the ecosystem stabilizes along a higher functioning trajectory. Past restoration projects focused on streams and other systems that have a substantial influence on water quality and clarity, which are key environmental issues in the Lake Tahoe basin. Restoration projects in these types of habitats have a stronger effect on wildlife, in general, than projects in upland habitats because riparian and meadow habitats provide more resources per acre (e.g., food, water, and cover) than uplands. See Appendix A for restoration projects that were completed in the wildlife analysis area since 1993.

Past engineering projects within the wildlife analysis area are listed EIP web page (shown above) and in Appendix A and include roads, trails, bridges, BMPs, building maintenance and construction, and similar projects. The effects of these types of actions on wildlife are highly variable, but may be better characterized depending on whether the action took place in an urban area, the urban interface, or out in the forest (i.e., beyond the WUI). Engineering projects within urban areas are likely to have little to no effect on the sensitive wildlife species analyzed because urban areas are generally either minimally or not suitable for them. Projects in the urban interface may have an effect dependent upon the location and the action taken. For example, Fountain Place (Oneidas) road, which is located in the urban interface and within one mile of known northern goshawk habitat, was chip-sealed in 1997 and may have affected sensitive wildlife by elevating anthropogenic disturbance slightly above background levels related to normal use of the road, followed by more than a decade of little to no effect as the road continued to be used as it was before project implementation.

Projects in the general forest, beyond the WUI, generally have a greater chance of affecting sensitive wildlife species because they or their habitats are known to occur there. For example, the Freel/Meiss Trail Access and Travel Management project implemented changes to trails in the general forest in 2006 that may have affected sensitive wildlife during implementation (i.e., minor audio/visual disturbances related to hand crews working on the trails) and likely affected long term habitat suitability positively (i.e., removing off-highway vehicle access in the upper reaches of Saxon Creek) and negatively (i.e., relocating that off-highway vehicle use to a lower reach closer to Trout Creek), although the net effect was expected to be slightly to moderately beneficial in the long term because sensitive wildlife were known to occur and nest in the upper reaches of Saxon Creek, but not in the area closer to Trout Creek. Past engineering projects may have caused disturbance to wildlife during implementation and likely have had a neutral or near neutral overall net effect on sensitive wildlife species.

Current Actions

Current vegetation projects include the thinning of federal and non-federal urban lots, thinning portions of the Fallen Leaf Lake Road and Tahoe Mountain Road corridors, high meadows die-off (bark beetle kill) thinning, removing hazard trees from the Angora Fire (2007) area, pile burning in several areas in and around South Lake Tahoe. Thinning of urban lots, including changes made to local regulations regarding the upper diameter limit (no permit required for trees up to 6 inches dbh, increased to 14 inches dbh, unless in the shore zone in which case a permit is required) that private homeowners may remove from their lots, is expected to have little or no effect to sensitive wildlife species because urban areas are generally either minimally or not suitable for them. Thinning of the Fallen Leaf Lake Road and Tahoe Mountain Road corridors is expected to have effects similar to those described for the proposed action, but on a much smaller scale (approximately 75 acres), limiting the scope of effects. Approximately 90 acres of bark beetle-killed and generally dense, even aged, early to mid-seral lodgepole pine (*Pinus contorta*) stands are being hand thinned in the High Meadows area, with effects to sensitive wildlife as for other thinning projects described.

The removal of hazard trees from roads and trails within the Angora Fire area is expected to increase anthropogenic disturbance above background levels during implementation, potentially causing a temporary change in behavior or slight change in patterns of habitat use to sensitive wildlife present in the area, but not to cause substantial long term effects to sensitive wildlife because trees that are being removed would fall on their own in time, no nest trees will be removed, and there are few hazard trees in comparison to the total number of trees present. Pile burning within the Angora Fire area continues as permitted by environmental conditions with effects as described for the proposed action above, but on a much smaller scale (approximately 10 acres), limiting the scope of effects.

Current restoration projects include Angora Creek fisheries enhancement (reach downstream of Lake Tahoe Boulevard by the County of Eldorado), Upper Truckee River (reach downstream of the midpoint of the South Lake Tahoe airport runway by the City of South Lake Tahoe), Lahontan cutthroat trout, and mountain yellow-legged frog habitat restoration in Desolation Wilderness. The Angora Creek fisheries enhancement project was completed in 2006, though nearby upstream portions of the Angora Creek watershed were affected by the 2007 Angora Fire. Additional restoration in response to the fire may include stabilization of stream-side zones just downstream of Lake Tahoe Boulevard. No effects to sensitive wildlife species are expected as the area is urbanized and experiencing elevated levels of anthropogenic disturbance due to the reconstruction of homes and developments on adjacent private lands. The Upper Truckee River restoration project is expected to restore approximately one mile of stream in open meadow habitats located within the City of South Lake Tahoe. The restoration will benefit the incised channel and adjacent meadows, which are experiencing reduced connectivity with the local water table. Riparian herbaceous and shrub vegetation is expected to improve in quality and quantity over the long term, and the benefits to sensitive wildlife are expected to be similar to those described for past restoration actions. The City of South Lake Tahoe reach of the Upper Truckee River is located within the urban interface and is part of the largest riparian/meadow system within the limits of the City of South Lake Tahoe.

Current engineering projects within the wildlife analysis area are listed on the EIP web page (shown above) and in Appendix A and, like past engineering projects, include roads, trails, bridges, BMPs, building maintenance, and similar projects. The effects of these types of actions on wildlife are highly variable, as described for past actions in urban areas, the urban interface, and lands beyond the WUI. None of the current engineering projects located within the wildlife analysis area are expected to cause substantial effects to sensitive wildlife species, though minor to moderate effects may occur in specific locations. For example, the Hawley Grade trail stabilization is being implemented in late seral, closed canopy, mixed conifer forest that is suitable habitat for some sensitive wildlife species, but surveys of the project area did not detect these species, so effects to individuals are unlikely. Habitat suitability in that section of the trail should be improved over the long term as the steep slope is stabilized and vegetation preserved, benefiting sensitive species habitat quality and quantity. In a differing example, the Tallac Creek bridge and channel reconstruction project is repairing damage caused by high flows within an obstructed channel. Potential disturbance to sensitive wildlife species is expected to increase above the background level of disturbance typical of that portion of the Spring Creek recreation residence tract during project implementation. Heavy equipment will be required in the riparian corridor within this urban interface. Following surveys for occupancy and reproductive activity, effects to the survival or reproduction of sensitive wildlife species are not expected. Habitat suitability is expected to be improved over the long term as erosion and destruction of riparian habitat is halted and set on a trajectory toward re-establishment of understory vegetation, including large deciduous riparian shrubs (e.g., alder and willows).

Reasonably Foreseeable Future Actions

Reasonably foreseeable future vegetation projects include mechanical and hand thinning of federal and non-federal urban lots, thinning of non-federal lands, removal of hazard trees from travel corridors (e.g., highways), and pile burning in and around South Lake Tahoe. The thinning of urban lots is expected to continue and to have little or no effect on sensitive wildlife species as urban areas are generally either minimally suitable or not suitable habitats. Mechanical and hand thinning of non-federal lands would be expected to continue at a rate similar to past and current treatments (an estimated 1,000 acres of reasonably foreseeable future treatments) with effects to wildlife as previously described for these types of operations and a scope commensurate with the number of acres treated. Removal of hazard trees from highway corridors would be expected to continue, but would have little to no effect on sensitive wildlife species as the typical range in which standing trees may pose a hazard to highways, parking lots, or similar developments (approximately 200 feet) is usually not suitable habitat. The effects of pile burning in general are described above and would occur as described for the proposed action, but on a much smaller scale (approximately 150 acres), limiting the scope of effects.

Reasonably foreseeable future restoration projects within the wildlife analysis area and the approximate number of miles of streams and/or acres of SEZ, floodplain, riparian, and meadow habitats they may restore (where planning has progressed far enough to estimate) is shown in Appendix A. The effects of these projects to wildlife would be expected to be similar to those described above for past and current restoration projects.

The aspen community, Angora Fire, Taylor-Tallac, and Upper Truckee River marsh reach restoration projects differ somewhat from past or current projects. The aspen community restoration project will restore aspen stands, like the proposed action, with similar effects to wildlife but over a smaller area. Previous aspen treatments (e.g., within the 2004 Cathedral Fuels project) took a more tentative approach than either the proposed action or aspen community restoration project in managing aspen because aspen stands frequently occur in sensitive SEZs which were often avoided in the past. The aspen treatments currently proposed are expected to provide greater benefits to wildlife than previous treatments by increasing the potential for aspen stand expansion by removing more conifers, with commensurate increased benefits to sensitive wildlife species over the long term.

The Angora Fire restoration project will address the largest burned area within the wildlife analysis area and Lake Tahoe basin since local fire suppression efforts began in 1911. Although the proposed action for the project has not been determined, the project will involve larger areas of early seral habitat than any of the other past, present, or reasonably foreseeable restoration projects in the wildlife analysis area. Wildlife that utilized early and mid-seral or burned habitats will likely benefit from the project over the next several decades as vegetation recovers and matures.

The Taylor-Tallac and Upper Truckee River marsh reach restoration projects differ from previous restoration projects in that they would restore large tracts of wetland systems directly adjacent to Lake Tahoe. These projects would likely affect wildlife as described for other restoration projects, with additional benefits to species that utilize shore zones. Future restoration projects will continue to be focused on streams and other systems that have a substantial influence on water quality and clarity. The reasonably foreseeable future restoration projects that may occur in the wildlife analysis area are also listed in Appendix A.

Reasonably foreseeable future engineering projects within the wildlife analysis area are listed on the EIP web page (shown above) and in Appendix A and, like current and past engineering projects, would continue to include road, trail, bridge, BMP, building maintenance, and similar projects. The effects of these types of actions to wildlife would likely be the same as those described above for past and present projects within urban areas, the urban interface, and lands beyond the WUI.

The Lake Tahoe greenway, Camp Richardson campground, and Taylor Creek environmental education center projects would likely involve more construction than other engineering projects previously discussed. The Lake Tahoe greenway project is a proposal to construct a paved bike trail from Meyers, California to Stateline, Nevada using existing easements and road and trail prisms where possible within the urban interface. Potential effects to wildlife from this project would likely vary from negligible (when using an existing paved trail within the neighborhoods along the route) to moderate (to upgrade a trail corridor within urban interface riparian habitats). The introduction of anthropogenic disturbance above background levels along portions of the travel corridor seems likely and, depending on location, may adversely affect wildlife. However, the multi-agency project would be expected to avoid using alignments that would cause substantial adverse impacts to sensitive wildlife species.

The Camp Richardson campground project involves the redesign of intensive recreational uses within a highly urbanized portion of the urban interface. A general improvement to the existing condition and related effects to wildlife is anticipated. Anthropogenic disturbance within the project area is expected to remain seasonally intensive, but slight benefits to adjacent habitats may occur as recreational use is better managed, benefiting wildlife in the short and long term.

The Taylor Creek environmental education center (proposed action not determined), which is located within and adjacent to the Taylor Creek riparian corridor and wetlands, may be redesigned to improve management of existing and anticipated future intensive recreational use. Short term impacts to wildlife related to building, road, and trail construction, demolition, and decommissioning seem likely, although the majority of activities would avoid sensitive habitats, especially during the periods when wildlife reproduction may be occurring, where possible. Long term benefits to wildlife would likely occur as the seasonally intensive recreational use would be better managed, including access to sensitive habitats.

Summary of Cumulative Effects

The context of the existing environment and current trends in the environment are relevant in considering past, present, and reasonably foreseeable future actions and determining general cumulative effects of the proposed action (further cumulative effects are presented in the species-specific analyses below). The existing environment within the wildlife analysis area, the context in which the proposed action would occur, is a product of history. Fluctuations in climate, culminating in a cool, wet period (1600-1775) in the late Holocene set the stage for the tree species composition and distribution present within the Lake Tahoe basin prior to the initiation of Comstock era logging (1860-1920). Decades of logging had a substantial effect on forest vegetation, with large tracts of clear cut lands, affecting an estimated 45 percent of the wildlife analysis area and 65 percent of the WUI project area. Changes in forest vegetation during this period were coupled with widespread cattle and sheep grazing (1850s-1950s) in meadows, wetlands, and riparian habitats. These perturbations from the natural range of variability were further exacerbated by nearly 100 years of fire suppression, resulting in the current condition where forested stands within the action area may be generally characterized as over-stocked and relatively even aged, at elevated risk of catastrophic wildland fire, and not trending toward the desired condition. Sensitive wildlife species within the wildlife analysis area are adapted to conditions within the natural range of variability and are presumed to derive the greatest benefits (e.g., increased fitness and reproductive success) from environmental conditions within that range.

Climate change is also relevant in considering the general cumulative effects of the proposed action to wildlife as the natural range of variability in habitats within the wildlife analysis area may be affected in the future, as demonstrated by our knowledge of habitats in and adjacent to the Lake Tahoe basin during the late Pleistocene and Holocene. If trends continue as suggested by current science, the local climate is likely to become drier and warmer. Average annual snow pack would be reduced and melt earlier in the season, shifting hydrologic activity earlier in the year and causing changes in some species reproductive timing (earlier), creating generally drier summertime conditions, and increasing the likelihood of wildland fire. Tree species composition and distribution would be expected to adapt to the changing conditions. The natural range of variability in wildlife habitat composition and distribution would be expected to change with the changing climate and vegetation. Details of how habitats within the wildlife analysis area will likely change are unknown, although some broad scale characterizations may be made. For example, subalpine conifer habitats (e.g., mountain hemlock, western white pine, and whitebark pine) may retreat upslope and to more northerly-facing aspects. Fire-adapted trees that grow well in dry soils (e.g., Jeffrey pine) may be favored over other tree species and expand in abundance or distribution. Vegetation types currently present on the warmer and drier southwestern-facing slopes within the wildlife analysis area may similarly expand as they are favored by the current direction of change in climate.

General cumulative effects are expected to vary across the wildlife analysis area because the effects of past, present, and reasonably foreseeable future actions vary spatially. The past, present, and future of one part of the wildlife analysis area may be quite different from those for another. Due to the complexity of these spatial variations, the direction, magnitude, and duration of general cumulative effects to wildlife may be best described by the following two gradients: the degree of human-caused perturbation and the sensitivity of wildlife species to these changes.

The degree of human changes may be characterized by whether an area is located within an urban core, the urban interface, or out beyond the urban interface. Clearly, human disturbance is highest in urbanized cores where the area has been Comstock-logged, developed, intensive fire suppression continues, and intensive use is likely in the future. A lesser degree of disturbance is expected to exist in the urban interface where there is less development, and activities are more dispersed than in urban cores; and the least is expected beyond the urban interface where there is little to no permanent development.

The sensitivity of a species to disturbance would determine how wildlife would respond. Species that deal well with or benefit from disturbance would be more likely to respond positively, and those species with low tolerances to disturbance would be more likely to be negatively affected. General cumulative effects to wildlife would be expected to transition from disturbance-type effects (e.g., the operation of equipment) during implementation toward habitat maturation-type effects (e.g., the growth of a stand toward desired conditions) over time. The spatial distribution and timing of the proposed action from the rotation of treatment units in watersheds in concert with past, present, and reasonably foreseeable future actions would influence this progression of cumulative effects.

Alternative 1 (No Action)

Under the No Action alternative, The South Shore project would not occur. Because there would be no direct or indirect effects from the project, there would also be no cumulative effects.

Alternative 2 (Proposed Action)

The general impact on the environment which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions is to alter the spatial distribution of wildlife and suitable wildlife habitats within the wildlife analysis area, particularly within the WUI. Short term disturbance-related cumulative effects to wildlife are expected, though impacts to sensitive species would be minimized by project design features. Long term, beneficial, cumulative effects to wildlife are expected as conditions within treated stands mature along desired trajectories in concert with restoration activities and improved land management practices. General ecosystem conditions, within the context of the existing environment and trends, are expected to trend toward desired conditions and the natural range of variability, resulting in improved ecosystem function, resilience to disturbance, and increased productivity. Further information is provided by individual species.

Alternative 3

Past, present, and reasonably foreseeable future actions related to Alternative 3 are the same as those described for the proposed action (Alternative 2) above. The summary of general cumulative effects in context of the existing environment, historic and current trends, and principles describing how cumulative effects would be distributed among wildlife species and across the landscape are also the same for Alternative 3 as those described for the proposed action except that fewer acres would be treated, slightly reducing the scope of effects. Alternative 3 would have different, and generally more positive, cumulative effects than the proposed action on some sensitive wildlife species as described by individual species below.

Individual Wildlife Species Existing Conditions and Effects

The following section discloses the existing conditions and the direct, indirect, and cumulative effects of the South Shore project for individual TES species. Species that are discussed include: Pacific fisher, California wolverine, Sierra Nevada red fox, American marten, Townsend's big-eared bat, bald eagle, northern goshawk, California spotted owl, great gray owl, and willow flycatcher.

Fisher

The fisher (*Martes pennanti*) is currently a U.S. Fish and Wildlife Service (USFWS) candidate (C) species. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Fisher Existing Conditions

Fishers occur in the northern coniferous and mixed forests of Canada and the northern contiguous United States, from the mountainous areas in the southern Yukon and Labrador Provinces in Canada southward to central California and Wyoming, the Great Lakes, New England, and Appalachian regions (Graham and Graham 1994; Powell 1993). The current North American distribution is substantially reduced from the historic distribution (Gibilisco 1994). The historic range in California and Oregon included the southern Cascade Ranges, northern Coastal Ranges, and Sierra Nevada Ranges (Zielinski et al. 1995, 2005) including the Lake Tahoe basin (Grinnell et al. 1937). The most recent records of this species on or adjacent to the LTBMU are: (1) just outside the western Lake Tahoe basin to the west of Barker Pass on the Tahoe National Forest in 1972; (2) on the west shore of Lake Tahoe in Sugar Pine State Park near the mouth of General Creek in 1984; and (3) in the project analysis area south of the South Upper Truckee bridge in Christmas Valley in 1967 (CDFG 2008).

In California, this species now occupies limited portions of the southern Cascades, northern Siskiyou Mountains, and southern Sierra Nevada on the Sequoia and Sierra National Forests. Recent surveys indicate that fisher are absent from their former range in the northern and central Sierra Nevada from Mount Shasta to Yosemite National Park, a distance of approximately 269 miles (Zielinski et al. 1995, 2005). Extensive carnivore surveys have occurred within the LTBMU over the past 10 years, including portions of the project area, and fisher have not been detected. Therefore the LTBMU is considered outside the current range of this species.

Fishers utilize forested habitats with specific vegetative and structural characteristics (Powell 1993; Buskirk and Powell 1994). Often associated with old forests, this species may prefer late seral conditions but it appears that other forest types are used when equivalent habitat functions of prey abundance, fisher protection from predation, and den site availability occur (Green et al. submitted). Fishers use forested landscapes that include conifer-dominated stands and prefer stands with low and closed canopies (Allen 1987; Buskirk and Powell 1994). Stands with vegetated understories and large, downed woody debris are selected as these characteristics appear important to their prey species (USDA FS 2001). Fishers avoid open areas with no overstory or shrub cover to reduce the risk of predation (Buskirk and Powell 1994) and habitats with deep, soft snow because of their heavy foot loadings (Powell and Zielinski 1994; Krohn et al. 1995, 1997). The following California Wildlife Habitat Relationships (CDFG 2005) types are important to fishers: structure classes 4M, 4D, 5M, 5D, and 6 (stands with trees 11 inches dbh or greater and greater than 40% cover) in ponderosa pine, montane hardwood-conifer, mixed conifer, montane riparian, aspen, red fir, Jeffrey pine, lodgepole pine, subalpine conifer, and eastside pine (Timossi 1990 *in* USDA FS 2001).

Fisher Direct, Indirect, and Cumulative Effects

Suitable habitats exist in and adjacent to the wildlife analysis area, but are outside the range of this species. Therefore, the project is not expected to affect fisher or its habitat in its current range. No direct or indirect effects are expected for the No Action alternative, proposed action, or Alternative 3 because they are outside the current range of the fisher and its habitat. No cumulative effects for the No Action alternative, Proposed Action, or Alternative 3 are expected for the fisher or its habitat because no direct or indirect effects are expected.

Determination

Alternatives 1, 2, and 3 Determination: It is the determination of the Forest wildlife biologist that the three alternatives for the South Shore project EIS will have **No Effect** on the Fisher. rationale: The proposed action and alternatives are located outside the current range of this species.

California Wolverine

The wolverine (*Gulo gulo*) is a Forest Service Sensitive (S) species on the Lake Tahoe Basin Management Unit. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Wolverine Existing Conditions

Wolverines have a circumpolar distribution and occupy the tundra, taiga, and forest zones of North America and Eurasia (Wilson 1982). The species uses a wide variety of forested and non-forested habitats in North America (Banci 1994). In California, wolverines once occurred throughout the Sierra Nevada, Cascades, Klamath, and northern Coast ranges in alpine, boreal forest, and mixed forest vegetation types (Grinnell et al. 1937, Schempf and White 1977). Following dramatic increases in human development and disturbance associated with the California gold rush of the mid-1800's (summarized in Zielinski et al. 2005); the distribution of wolverine in California was limited to the central and southern Sierra Nevada only (Ibid, Schempf and White 1977).

An extensive furbearer study conducted from 1996 to 2002 by the USFS, Pacific Southwest Research Station (PSW) using track plates and cameras on approximately 7,500,000 acres in the southernmost Cascades and Sierra Nevada range did not detect this species and found that wolverines may be extirpated from or occur in extremely low densities within the area sampled (Zielinski et al. 2005). Extensive carnivore surveys have occurred on the LTBMU over the past 10 years, including portions of the project area, and wolverines have not been detected.

On February 28, 2008, a detection of a lone male wolverine occurred approximately 14-19 miles northwest of the LTBMU (approximately 33-38 miles from the wildlife analysis area) near Truckee, California. Detections of this individual continued in the same area into March 2008. Agency biologists and researchers are attempting to determine the population of origin for this individual and preliminary results from genetic samples suggest that the wolverine is not related to either the historic California population (compared to samples taken from museum specimens) or contemporary northern Cascades (Washington) population (Kris Boatner – Wildlife Biologist, Tahoe National Forest, personal communication 2008). In summary, detections of wolverine or their den sites have not occurred within 5 miles of the project area within the past two years;

however the contemporary range of this species appears uncertain and may include limited portions of the wildlife analysis area.

The LRMP, as amended by the Sierra Nevada Forest Plan Amendment (2004), directs Forests to consider whether project activities have potential to affect the wolverine within five miles of a detection for a 2-year period (when not associated with a den site). The most recent records (other than the 2008 sighting on the Tahoe National Forest) of this species on or adjacent to the LTBMU are as follows: (1) approximately 2 miles west of the LTBMU near Island Lake on the Eldorado National Forest in 1994, (2) approximately one mile northwest of the analysis area in Emerald Bay between Highway 50 and Eagle Lake in 1990, (3) approximately 5.5 miles west of the LTBMU near Strawberry, CA in 1971, (4) approximately one mile northwest of the LTBMU near the Lower Truckee River at the east end of Squaw Valley in 1953, and (5) adjacent to the analysis area on Echo Summit at Highway 50 in 1941 (CDFG 2008). None of these detections occurred in association with a den site.

Home ranges in North America range from less than 38 square miles (100 km^2) to over 346 square miles (900 km^2). Home ranges within the Sierra Nevada remain unknown. Males typically have larger home ranges than females, especially those with young. Male home ranges increase during the breeding season, likely driven by the distribution of females.

Wolverine use diverse, coniferous forest types (Copeland 1996, Hornocker and Hash 1981) and non-forested alpine habitats (Banci 1994 and Copeland 1996). Suitable habitat may be "best defined in terms of adequate year-round food supplies in large, sparsely inhabited wilderness areas, rather than in terms of particular types of topography or plant associations" (Kelsall 1981 *in* Ruggiero et al. 1994). Natal dens described in California were under rock 'shelves' at elevations above 10,000 feet (Grinnell et al. 1937 *in* USDA FS 2001). This habitat generalist appears to select areas that are free of substantial human disturbance and requires den sites associated with structural cover (e.g., boulders and persistent snow cover) in cirque basins or avalanche chutes at high elevations (summarized in USDA FS 2001).

For purposes of this analysis, high and moderate capability wolverine habitat within the wildlife analysis area includes areas free of significant human disturbance and located above 10,000 feet elevation with CWHR vegetation strata described as follows:

- High capability denning, resting, and foraging habitats - alpine dwarf shrub (all strata), lodgepole pine (5M and 5D), red fir (5M and 5D), and subalpine conifer (5M and 5D);
- Moderate capability denning, resting, and foraging habitats - lodgepole pine (all strata except 2S, 5M, and 5D), red fir (all strata except 5M and 5D), and subalpine conifer (all strata except 5M and 5D). wet meadows also provide moderate foraging habitat.

Areas free of significant human disturbance were identified as those with a land-use equivalent to TRPA Land Conservation Areas (LCAs) (TRPA Code of Ordinances, as amended) and greater than 1.0 mile from homes and businesses. LCAs are "areas with value as primitive or natural areas, with strong limitations on use, and with a potential for dispersed recreation or low intensity resource management" (Ibid). These areas may include "high-hazard lands, stream environment zones, and other fragile areas, without substantial existing improvements; isolated areas which do not contain the necessary structure for development; areas capable of sustaining only passive recreation or non-intensive agriculture; or areas suitable for low to moderate resource management" (Ibid). LCAs are presumed to have lower levels of human disturbance than other land-use types. However, as LCAs often occur adjacent to neighborhoods or as isolated islands within a matrix of more highly-disturbed land types and because anthropogenic disturbance extends beyond land-use boundaries, the more highly-disturbed land type areas were spatially buffered for this analysis. The 1.0 mile buffer used for wolverine denning habitat represents best professional opinion based on local knowledge of area-specific recreation, dispersed recreation, and other sources of disturbance in the South Shore area.

Moderate and high capability resting and foraging habitats include the CWHR vegetation strata described above and freedom from disturbance but without the minimum elevation (10,000 feet). Estimated acres of wolverine denning habitat, resting habitat, and foraging habitat within the wildlife analysis area are given under effects in Table 3-73.

California Wolverine Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Wildland fire would continue to threaten further coarse scale fragmentation of this species habitat. Anthropogenic disturbance and development would continue to restrict the range and distribution of this species. Wolverines would continue to be extirpated from or occur in extremely low densities within the wildlife analysis area. Suitable wolverine habitats would not be affected by this alternative. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Wolverines are sensitive to disturbance and avoid urban areas and portions of the WUI that are impacted by ongoing anthropogenic disturbance. As the action alternatives would occur in the WUI and this species is expected to generally avoid the WUI, the potential for effects to wolverine are limited. Desolation Wilderness, Echo Summit, Meiss Roadless Area, Luther Pass, and the Freel Peak massif (i.e., the more remote, high elevation habitats in the wildlife analysis area) are the most likely areas where wolverine may be affected, if this species is not currently extirpated from the Lake Tahoe basin and surrounding area. Effects during implementation would likely be limited to a temporary change in patterns of habitat use (i.e., avoidance of areas with ongoing project activities) by this highly mobile and wary species, though the risk of affecting individual wolverines is low due to the extremely low density or extirpation of this species within stands that would be treated in either action alternative. Fine scale habitat fragmentation (i.e., fragmentation within stands) may result from either action alternative where treatments occur in suitable wolverine habitat, most likely at Echo Summit or Luther Pass where the WUI intersects high elevation habitats. Fine scale habitat fragmentation is not expected to impact connectivity between suitable habitats as forested linkages would be retained since no clear cuts or group selections would occur and landings within mechanical units would not be large enough to affect habitat connectivity. Risk of coarse scale fragmentation, such as the 2007 Angora Fire, from wildland fire or large scale pathogen-induced stand mortality would be reduced in treatment areas. Implementation of either action alternative is not expected to cause additional coarse scale fragmentation of wolverine habitat.

The estimated number of acres of high and moderate capability wolverine denning, resting, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-73. Total existing acres of these habitats within the wildlife analysis area are included for comparison. Alternatives 2 and 3 would not affect wolverine denning habitat because treatments would not occur within approximately 1.4 miles of remote habitats above 10,000 feet elevation (i.e., near the Freel Peak massif). Therefore, effects to wolverine reproduction are not expected. No net changes in resting or foraging habitats are expected, although approximately five percent (40 acres) of moderate capability resting and foraging habitats may be converted to high capability habitats. The potential of Alternative 3 to affect wolverines or their habitat is expected to be slightly less because alternative 3 would treat fewer acres of suitable wolverine habitats. Either action alternative would affect less than four percent of suitable wolverine habitats within the wildlife analysis area.

Table 3-73. Estimated acres of high and moderate capability wolverine habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 in comparison to the wildlife analysis area

	Habitat Capability	Denning Habitat		Resting Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	0	0	19	+40	19	+40
		0		59		59	
	Moderate	0	0	785	-40	785	-40
		0		745		745	
	Total	0	0	804	0	804	0
		0		804		804	
Alternative 3	High	0	0	19	+40	19	+40
		0		59		59	
	Moderate	0	0	746	-40	746	-40
		0		706		706	
	Total	0	0	765	0	765	0
		0		765		765	
Wildlife analysis area	High	35		1,658		1,658	
	Moderate	59		21,120		21,685	
	Total	94		22,778		23,343	

California Wolverine Cumulative Effects

Alternative 1

No direct or indirect effects would occur under the No Action alternative; therefore no cumulative effects would occur.

Alternative 2

The proposed action, when combined with past, present, and reasonably foreseeable future actions is not expected to have a cumulative effect to wolverine because the risk of potential disturbance-type effects is low; less than four percent of suitable habitats would be treated and those are located in the WUI, which this species tends to avoid. No cumulative effect to wolverine habitat is expected because no suitable habitats would be lost and habitat connectivity would be retained in the wildlife analysis area during and after implementation as stands mature during the 15-year period following implementation.

Alternative 3

Cumulative effects for Alternative 3 are the same as those for Alternative 2 except that the scope of effects is slightly reduced as fewer acres would be treated (765 acres in Alternative 3 compared to 804 acres in Alternative 2).

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the California Wolverine.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore project EIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the California wolverine. Rationale:

- Disturbance-type effects (e.g., individual wolverines avoiding project equipment) are unlikely, but may occur during implementation
- Fine scale fragmentation may occur but is not expected to affect habitat connectivity as forested and other suitable linkages would be retained on the landscape
- Coarse scale fragmentation is not expected to occur and risk of coarse scale fragmentation from natural causes (e.g., wildland fire or pathogen-induced stand mortality) would be reduced
- No denning habitats would be affected and less than four percent of resting and foraging habitats within the wildlife analysis area would be affected

Sierra Nevada Red Fox

The Sierra Nevada red fox (*Vulpes vulpes necator*) is a Forest Service Sensitive (S) species on the Lake Tahoe Basin Management Unit. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Sierra Nevada Red Fox Existing Conditions

The red fox (*Vulpes vulpes*) occurs in a wide range of habitats including deserts, tundra, mountains, agricultural lands, and urban areas throughout their global range (summarized in Perrine 2005). Three of the North American subspecies, including the Sierra Nevada red fox (*V. v. necator*), prefer subalpine meadows and parklands within boreal forests (Ibid). The Sierra Nevada red fox is a California native species whose distribution appears to have been restricted to elevations above 5,000 feet in the Sierra Nevada and Cascade mountain ranges following dramatic increases in human development and disturbance associated with the California gold rush of the mid-1800’s (Grinnell et al. 1937, Schempf and White 1977, and summarized in Zielinski et al. 2005). A separate population of red foxes, reportedly introduced and definitely expanding in range, occupies lower elevations in California including the Sacramento and San Joaquin Valleys, San Francisco Bay-Delta area, the southern California Coast Range and Coastal Plain and most major urban areas (Lewis et al. 1999, Perrine 2005). Whether this exotic red fox, suggested to be derived from the red fox of the northern Great Plains (*V. v. regalis*) (Roest 1977), has expanded into the range of the native Sierra Nevada red fox remains unclear (Lewis et al. 1995). A crude dividing line at 3,500 feet elevation has been used to differentiate between native and exotic red fox populations (Lewis et al. 1993, Perrine 2005). The elevation boundary between the two populations is somewhat arbitrary and likely varies by latitude (Perrine 2005).

The current range of the Sierra Nevada red fox may be limited primarily to the southern Cascades as the Sierra Nevada population appears to be either extirpated or occurring at extremely low densities (Perrine 2005, Zielinski et al. 2005). The extensive PSW furbearer study mentioned previously (see Wolverine), conducted from 1996 to 2002 using track plates and cameras on approximately 7.5 million acres in the southernmost Cascades and Sierra Nevada range (estimated 60 of 344 sample units located within suitable Sierra Nevada red fox habitats), did not detect this species and found that Sierra Nevada red fox may be extirpated from or occur in extremely low densities within the area sampled (Zielinski et al. 2005). The gap in distribution between the Cascade and Sierra Nevada mountains suspected by Grinnell et al. (1937) was confirmed by Zielinski et al. (2005). A population of red fox in the Cascades near Lassen Peak was identified as the native *V. v. necator* through analysis of mtDNA samples (Perrine 2005). However, it remains unclear why the red fox population recently known to occur near Lassen

Peak was not detected by the PSW study. It was suggested by Perrine (2005) that the range of the Lassen foxes may have been so restricted that the PSW study simply missed them. A comparison between the sampling locations for the two studies showed that the PSW plots did not fall within the grid cells where the Lassen study detected this species (Ibid).

Home ranges of Sierra Nevada red fox in Lassen National Park averaged 940 acres (2,323 hectares) in summer and 1,318 acres (3,255 hectares) in winter. Winter home ranges were located at lower elevations (mean=1,571 feet) and typically did not overlap with summer home ranges. Altitudinal movement down-slope in winter was presumed to be associated with snow pack depth. Given the body size and foot-loadings typical for this species, individuals would likely experience difficulty in accessing under-snow prey habitats and high energetic costs in traveling over snow (Perrine 2005). Little is known about reproduction of this species in the Sierra Nevada. This species breeds during winter, has a gestation period of 52-54 days, and has litters of 3 to 9 pups (mean=6) during the summer (summarized in Perrine 2005).

The LRMP, as amended by the Sierra Nevada Forest Plan Amendment (2004), directs Forests to consider whether project activities have potential to affect the Sierra Nevada red fox within 5 miles of a detection for a 2-year period (when not associated with a den site). Extensive carnivore surveys have occurred on the LTBMU over the past 10 years, including portions of the project area: Sierra Nevada red foxes were not detected. The most recent record of this species near the LTBMU occurred approximately 4.4 miles southeast of the Lake Tahoe basin in Charity Valley, near Markleeville Peak in 1973 (CDFG 2008). This detection was not associated with a den site. In summary, detections of Sierra Nevada red fox or their den sites have not occurred within 5 miles of the project area within the past two years; however the contemporary range of this species appears uncertain and may include limited portions of the wildlife analysis area.

Sierra Nevada red fox occur in red fir, lodgepole, subalpine forests, and alpine fell-fields, preferring open areas such as those found above timberline, in meadows, and in open forested stands (summarized in Schempf and White 1977). CWHR (2005) addresses red fox (*V. vulpes*), but not Sierra Nevada red fox. No high or moderate capability denning or resting habitats are identified for red fox by CWHR. High capability foraging habitat is described as Alpine Dwarf-Shrub (all strata) and Wet Meadow (all strata) vegetation types; and moderate capability foraging habitat as the Subalpine Conifer (all strata except 3M, 3D, 4M, and 4D) vegetation type (CWHR 2005). Denning habitat, in the scientific literature, is described as "log or rock structures adjacent to meadows" (USDA FS 2001) and natural cavities within rock piles and talus slopes (Grinnell et al. 1937, Zeiner et al. 1990 in USDA FS 2001, Perrine 2005). Dens are also located in whitebark pine (*Pinus albicaulis*) and mountain hemlock (*Tsuga mertensiana*) subalpine habitats below treeline (summarized in Perrine 2005). This species "seems to range from 4,000 feet to 12,000 feet in elevation," though "they are seldom sighted below 5,000 feet, and most often above 7,000 feet" (USDA FS 2001). The Sierra Nevada red fox "ranges over wide tracts of land and may occur almost everywhere within its elevation range" (Grinnell et al. 1937 in Schempf and White 1977). The availability of prey and cover in suitable habitats appear important (USDA FS 2001) as does the amount, and preferably absence, of human presence and disturbance (Grinnell et al. 1937 in USDA FS 2001).

For purposes of this analysis, moderate and high capability denning and resting habitats were considered to be greater than 1.0 mile from human disturbance and include whitebark pine and mountain hemlock subalpine habitats below treeline, which depends on local conditions and can not be described by a simple elevation boundary within the Lake Tahoe basin. Moderate and high capability foraging habitat includes habitats described above that are removed from human disturbance and are within the range of elevation for this species (4,000-12,000 feet). Estimates of high and moderate capability denning habitat, high and moderate capability resting habitat, and high and moderate capability foraging habitat currently within the wildlife analysis area are listed in Table 3-74 below.

Sierra Nevada Red Fox Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Wildland fire would continue to threaten further coarse scale fragmentation of this species habitat. Anthropogenic disturbance and development would continue to restrict the range and distribution of this species. Sierra Nevada red foxes would continue to be extirpated from or occur in extremely low densities within the wildlife analysis area. Suitable Sierra Nevada red fox habitats would not be affected by this alternative. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

The wildlife analysis area is within the range of the Sierra Nevada red fox, though this species may be extirpated or occur in extremely low densities. The action alternatives would not occur in suitable denning, resting, or foraging habitats, therefore direct and indirect effects to Sierra Nevada red fox or its habitat would not occur. No suitable habitats are expected to be created as the result of implementation of either action alternative. The estimated number of acres of high and moderate capability Sierra Nevada red fox denning, resting, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-74. Total existing acres of these habitats within the wildlife analysis area are included in this table.

Table 3-74. Estimated acres of high and moderate capability Sierra Nevada red fox habitat within the project area before and after implementation of Alternatives 2 and 3 in comparison to the wildlife analysis area

	Habitat Capability	Denning Habitat		Resting Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	0 / 0	0	0 / 0	0	0 / 0	0
	Moderate	0 / 0	0	0 / 0	0	0 / 0	0
	Total	0 / 0	0	0 / 0	0	0 / 0	0
Alternative 3	High	0 / 0	0	0 / 0	0	0 / 0	0
	Moderate	0 / 0	0	0 / 0	0	0 / 0	0
	Total	0 / 0	0	0 / 0	0	0 / 0	0
Wildlife Analysis Area	High	1,283		2,105		2,102	
	Moderate					2,105	
	Total	1,283		2,105		4,207	

Sierra Nevada Red Fox Cumulative Effects – All Alternatives

No direct or indirect effects to the Sierra Nevada red fox or its habitat would occur under any alternative; therefore no cumulative effects would occur under any alternative.

Determination – All Alternatives

Alternatives 1, 2, and 3 Determination: It is the determination of the Forest wildlife biologist that the three alternatives for the South Shore project EIS will have **No Effect** on the Sierra Nevada Red Fox. Rationale: The proposed action would not occur within or create suitable habitats for this species.

American Marten

The American marten (*Martes americana*) is a Forest Service sensitive (S) species and Management Indicator Species (MIS) on the Lake Tahoe Basin Management Unit. Please refer to the Management Indicator Species Report for this project for further discussion of this species and its habitat in regards to its MIS status. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

American Marten Existing Conditions

The American marten (*M. americana*) is one of four closely related species in the genus *Martes*, along with the Eurasian pine marten (*M. martes*), sable (*M. zibellina*), and Japanese marten (*M. melampus*). Together, they are called the "boreal forest martens" (Buskirk and Ruggiero 1994). These closely related species replace each other geographically in a boreal forest distribution around the world (Ibid). American martens are the only *Martes* species in North America, aside from the fisher (*M. pennanti*), and are broadly distributed from northern New Mexico to the northern limit of trees in arctic Alaska and Canada, and from the southern Sierra Nevada range in California to Newfoundland Island (Hall 1981 *in* Buskirk and Ruggiero 1994). This species is continuously distributed in Alaska and Canada, but discontinuously distributed in the western contiguous United States, where it occurs only in mountain ranges with preferred habitats. Marten occurrence appears to be associated with protected areas such as National Parks and Wildernesses, and late seral forests. Timber harvest, development, and fur-trapping (which occurred until the mid-1950s) have adversely impacted the distribution of this species (Zielinski et al. 2005). In California, marten occur in the southern Cascades and northern Sierra Nevada south to Tulare County. A gap in distribution has recently developed between the Cascade and Sierra Nevada mountain ranges. Distribution within the Sierra Nevada range is continuous at higher elevations; and Marten occur in suitable habitats throughout the Lake Tahoe basin.

Surveys for this species have been conducted throughout large portions of the Forest including the wildlife analysis area. These surveys varied in scope from a few to tens of stations and occurred sporadically since the 1980's. Most of the surveys occurred in the western, northern, and southeastern portions of the Lake Tahoe basin. Camera and/or track plate surveys for marten were not conducted for this project because marten are known to occur throughout much of the wildlife analysis area. However, marten dens have not been identified on the Lake Tahoe basin.

Marten occur in or near conifer forests, often in talus fields above treeline, but rarely or never below the lower elevational limit of trees (summarized in Buskirk and Ruggiero 1994). Suitable montane habitats in the northern Sierra Nevada, including the Lake Tahoe basin, occur between 3,400 and 10,400 feet elevation. This species is associated with "late-successional stands of moist conifers, especially those with complex physical structure near the ground" (Buskirk and Powell 1994 *in* Buskirk and Ruggiero 1994). Protection from predation, thermal cover, and availability of prey influence habitat selection. Predators of martens include coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), and great horned owls (*Bubo virginianus*). Marten are thought to utilize coarse woody debris or talus to avoid predation by these species.

However, predation by its larger relative, the fisher, is generally avoided geographically as a function of snow depth and/or shrub cover. Marten occur in regions with greater snow pack (>9.2 in) compared to fisher (<5.2 in) and overlap in distribution with their larger and heavier cousin in areas of intermediate snow pack. Lower foot-loading, with its associated advantage in mobility over snow, is presumed to benefit marten in interactions between the two species. In lieu of snow pack, dense shrub cover may also provide an advantage to marten during these interactions (Zielinski et al. 2006).

Complex ground cover structure is valuable as thermal cover, especially during winter, for denning, and as foraging habitat. Marten gain access to spaces under the snow created by coarse woody debris and other structures to forage, rest, and den. Squirrel middens often provide natal and maternal denning and resting sites (Buskirk and Ruggiero 1994). Marten also benefit from an interspersion of open areas within forested habitats, which increase foraging opportunities for mice (*Clethrionomys* and *Microtus*), chipmunks (*Eutamias*), pikas (*Ochotona*), and other small mammals (Perrine 2005).

Habitat connectivity is naturally limited by the spatial distribution of suitable habitats on the landscape. Green (2007) found that marten frequently occurred in continuous stands of Sierran mixed conifer, red fir, and subalpine forest dominated by large trees (size classes 5 and 6) and dense canopy cover at sites in western and southwestern parts of Sequoia and Kings Canyon National Parks. However, in northern and eastern parts of the parks, Green found that marten in higher elevations utilized areas with smaller diameter trees (mean tree size class 4) and lower canopy cover (range from <10% to dense) that were less continuous, “often occurring in linear patches along streams or around edges of lakes” (2007). Continuity of forested habitat in high elevation areas may be aided by the presence of boulder fields, talus slopes, abundant surface rocks, and/or shrubs (Grinnell et al. 1937, Buskirk and Zielinski 2003, Slauson 2003, summarized in Green 2007). These sources of thermal, predator, and/or foraging cover are likely important as linkages between preferred habitats and, at the landscape level, for habitat connectivity.

Habitat fragmentation is generally considered detrimental to marten occurrence. Fragmentation can be defined as “loss of stand area, loss of stand interior area, changes in relative or absolute amounts of stand edge, and changes in insularity” (Turner 1989 in Buskirk and Ruggiero 1994). Human-caused habitat fragmentation through logging and development has been identified as an important element in the conservation of marten populations. Habitat fragmentation may also occur due to fire or climate change.

Home ranges in the Sierra Nevada average 1,505 acres for males and 737 acres for females (USDA FS 2001). Females appear more habitat-selective than males, presumably due to higher energy requirements for reproduction (Buskirk and Ruggiero 1994). Marten do not alter their home ranges seasonally; though habitat use within the home range varies. Areas of greater cover, for example, are utilized during periods of inclement weather, and areas with large structural cover are used seasonally as den sites. Breeding occurs from late June to early August, peaking in July. Young are born in March and April. Young may be moved from the natal den to a maternal den(s) and emerge at approximately 50 days. Juveniles become independent in late summer but disperse later (summarized in Buskirk and Ruggiero 1994). There is some evidence that juveniles avoid high quality habitats occupied by adults (Ibid).

Important forest types include red fir, lodgepole pine, subalpine conifer, mixed conifer-fir, Jeffrey pine, and eastside pine (Zeiner et al. 1990 *in* USDA FS 2001). Habitat types and strata located within TRPA residential, commercial, or tourist accommodation plan area statement land use zones with high human disturbance do not provide suitable habitat for marten and were not included in this analysis. Estimated acres of high and moderate capability denning habitat, high and moderate capability resting habitat, and high and moderate capability foraging habitat currently existing for American marten within the wildlife analysis area are listed in Table 3-75.

American Marten Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Wildland fire would continue to threaten further coarse scale fragmentation of this species habitat. Human disturbance and development would continue to restrict the range and distribution of this species. Marten would continue to occur within proposed treatment stands and the wildlife analysis area. Suitable marten habitats would not be affected by this alternative. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Marten are sensitive to disturbance and avoid urban areas and portions of the WUI that are impacted by intensive human disturbance. This species may use portions of the WUI with light to moderate levels of disturbance when sufficient cover is present and linkages to preferred habitats exist. For example, marten have been observed within the WUI defense zone at Beaver Bridge on Cold Creek where abundant riparian vegetation provides adequate cover from occasional recreational users and dogs. However, effects to marten are most likely to occur in treatments stands located within high capability habitat in an area with little to no human disturbance or habitat fragmentation. Effects to marten are likely to include displacement of individuals through people or equipment flushing an individual and changes in patterns of habitat use to avoid areas with ongoing project activities. Direct mortality from equipment killing an individual is unlikely to occur to this highly mobile and wary species. Effects to marten habitat would include changes in available denning, resting, and foraging habitats for either action alternative.

The estimated number of acres of high and moderate capability marten denning, resting, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-75. Total existing acres of these habitats within the wildlife analysis area are included in this table for comparison.

Project design features would protect denning marten and their habitat if a den site is discovered prior to or during implementation, minimizing potential direct effects to marten reproduction.

High and moderate capability denning habitat available within the wildlife analysis area would be reduced by approximately three percent in either action alternative. Resting and foraging habitats would also be reduced by implementation of either action alternative. Available resting habitat would decrease by approximately two percent in Alternative 2 and one percent in Alternative 3. Available foraging habitat would decrease by approximately one percent in both alternatives.

A limited amount of moderate capability resting and foraging habitats would be converted to high capability habitats (212 acres in Alternative 2 and 197 acres in Alternative 3). The predicted increase in capability of these habitats is likely due to increased mean tree diameter within treatment stands, causing increases in CWHR size classes. Treated stands would be expected to mature along trajectories beneficial to marten with increasing radial and lateral growth, improving canopy structure and cover, and increasing stand resistance to drought, insects, disease, and fire during the 15 years after implementation. Increased radial and lateral growth would benefit marten by providing greater cover and connectivity between early seral or lower canopy habitats and mid- to upper canopy habitats to reduce the current structural disconnection often apparent in even-aged, densely stocked stands. The potential of Alternative 3 to affect marten or their habitat is expected to be slightly less than Alternative 2 because Alternative 3 would treat fewer acres of suitable marten habitats. Either action alternative would affect approximately three percent or less of suitable marten habitats within the wildlife analysis area.

Table 3-75. Estimated acres of high and moderate capability marten habitat within the project area before and after implementation of Alternatives 2 or 3 in comparison to the wildlife analysis area

	Habitat Capability	Denning Habitat		Resting Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	789 / 671	-118	1,003 / 1,215	+212	1,003 / 1,215	+212
	Moderate	7,461 / 6,375	-1,086	7,476 / 6,509	-967	7,476 / 6,611	-865
	Total	8,250 / 7,046	-1,204	8,479 / 7,724	-755	8,479 / 7,826	-653
Alternative 3	High	777 / 644	-133	980 / 1,177	+197	980 / 1,177	+197
	Moderate	6,923 / 6,108	-815	6,966 / 6,247	-719	6,966 / 6,350	-616
	Total	7,700 / 6,752	-948	7,946 / 7,424	-522	7,946 / 7,527	-419
Wildlife Analysis Area	High	9,272		9,346		12,073	
	Moderate	27,923		27,566		39,407	
	Total	37,195		36,912		51,480	

Fine scale habitat fragmentation (i.e., fragmentation within stands) would result from either action alternative where treatments occur in suitable marten habitat. Fine scale fragmentation may occur due to reductions in stand area or interior area or changes in stand edge (relative or absolute) or insularity. Stand area would not be substantially reduced in either action alternative as clear cuts or stand selections are not proposed, though some stand reduction would occur associated with construction of temporary roads or landings. The specific reductions in stand area from landing construction for either action alternative is unknown, but bounded by the upper limits of the total number of acres required for existing and constructed landings (estimated at 150-200 acres for Alternative 2 and 100-153 acres for Alternative 3).

Existing landings would be used where possible, logically limiting reduction of stand area from the construction of new landings to less than the acreages required for all landings. Reductions of stand interior area, edge, or insularity associated with the construction of new temporary roads and landings, as described above, would be expected in either alternative. These reductions would depend upon the spatial location of the roads and landings in relation to each stand. For example, a road and landing constructed on the edge of a stand would have a small effect of stand edge and insularity compared to the same road and landing constructed in the center of an otherwise undisturbed stand. These changes in fine scale fragmentation within suitable marten habitats would be relatively small compared to the total acreage treated (e.g., 150 acres of landings is equivalent to approximately one percent of the 10,670 acres that would be treated in Alternative 2) and wildlife analysis area (e.g., 150 acres of landings is equivalent to approximately 0.4 percent of the estimated 37,195 acres of denning habitat within the wildlife analysis area;

however, the percentage of denning habitat affected would be expected to be even less than 0.4 percent as sites used for landings may not currently be suitable denning habitat).

Thinning stands may, depending on treatment prescriptions and post-treatment stand structure, result in a reduction to stand insularity as visual and acoustic barriers are removed. Stand insularity is highly variable at the landscape scale, and would be reduced most in stands within the WUI defense zone where stand insularity is currently low due to human disturbance. Stand insularity would be reduced least in stands within PACs where treatment prescriptions retain more basal area, canopy cover, snags, and coarse woody debris. Alternative 3 would reduce stand insularity less than Alternative 2 because fewer acres would be treated and treatments would result in more acres of greater basal area, canopy cover, snags, and coarse woody debris (CWD). Project design features specify snag and CWD retention within the project area. General forest conditions after treatment and an average of three snags per acre and ten tons of CWD per acre would provide cover for marten. Greater cover would exist after treatment within PACs, retaining an average of six snags per acre and 15 tons of CWD in Westside mixed-conifer forest. Additional cover would develop from increased lateral and radial growth, CWD recruitment, and understory shrub and tree growth as stands matured during the 15 years after treatment. Patterns of marten habitat use would be influenced by this cover and by human disturbance. Increased recreational access related to thinning making stands easier for the public to enter will be discouraged through installation of barriers at or along key locations such as roads and trails. No new permanent roads or trails would be created by implementation of either action alternative. Fine scale habitat fragmentation would be expected to decrease during the 15 years following project implementation as early seral vegetation becomes established and grows on closed and restored temporary roads and landings.

Coarse scale fragmentation (i.e., fragmentation at the landscape scale) is not expected to result from either action alternative. Individual stands, or portions of stands, that are currently suitable habitat for marten would not be as suitable after implementation for denning, resting, and foraging habitats. However, the reduction in existing suitable habitats compared to the amount of suitable habitats available after implementation (e.g., estimated reduction of 1,204 acres out of 37,195 acres of denning habitat in the wildlife analysis area) and spatial distribution of suitable habitats following implementation is not expected to cause or lead to coarse scale fragmentation. Risk of coarse scale fragmentation from wildland fire (e.g., the 2007 Angora Fire) or large scale pathogen-induced stand mortality would be reduced in treatment areas.

Climate change has the potential to affect coarse scale fragmentation as forest composition and distribution change over the 15 years following implementation (and beyond), though the potential change is thought to be small (i.e., forest conditions are not expected to undergo a radical transformation during the period analyzed). If climate change causes conifers to move upslope and/or shrub cover on warmer, drier aspects increases, the existing pattern of coarse scale fragmentation may shift slightly, but connectivity of preferred habitats is expected to persist. Suitable habitat in treated stands (in either action alternative) and suitable habitat in untreated stands would provide linkages between preferred habitats on the landscape. No new barriers to marten movement or distribution are expected to be created by the implementation of either action alternative.

A reduction in habitat connectivity due to project implementation would logically be related to and roughly commensurate with the estimated change in suitable habitat (i.e., a small change in available habitat would likely cause a small change in habitat connectivity), though the relationship is not linear and arithmetic (i.e., a one percent decrease in available habitat would not necessarily cause a one percent decrease in connectivity) because connectivity is influenced by spatial relationships between suitable and unsuitable habitats. Connectivity between large tracts of high capability habitats (e.g., the Freel Peak massif and the Upper Truckee River watershed) would be retained in either action alternative. Habitat connectivity at the landscape scale is expected to be preserved at a level similar to, but slightly less than, the existing condition under either action alternative.

American Martin Cumulative Effects

Alternative 1

No direct or indirect effects would occur; therefore no cumulative effects would occur.

Alternative 2

The proposed action, when combined with past, present, and reasonably foreseeable future actions is not expected to have a cumulative effect to marten because a relatively small proportion of available habitats would be affected and large tracts of high and moderate capability habitats and habitat connectivity would be retained. The distribution of suitable marten habitat would not change substantially. The proposed action would contribute to increased disturbance to individual marten or marten habitat through fine scale fragmentation within the WUI. Alternative 2 would also contribute to a reduced risk of coarse scale fragmentation from human causes (e.g., Showers or Gondola wildland fires) within and outside the WUI.

Alternative 3

Cumulative effects for Alternative 3 are the same as those for Alternative 2 except that the scope of effects would be slightly reduced as fewer acres would be treated (Table 3-75) and less fine scale habitat fragmentation would occur.

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the American Marten.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore project DEIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the American Marten. rationale:

- Disturbance-type effects (e.g., individual marten avoiding project equipment) are likely to occur during implementation
- Fine scale fragmentation would occur but is not expected to affect habitat connectivity as suitable linkages would be retained on the landscape
- Coarse scale fragmentation is not expected to occur and the risk of coarse scale fragmentation (e.g., wildland fire or pathogen-induced stand mortality) would be reduced
- Less than four percent of denning, resting and foraging habitats within the wildlife analysis area would be affected

Townsend’s Big-eared Bat

Townsend’s big-eared bat (*Corynorhinus townsendii*) is a Forest Service Sensitive (S) species on the Lake Tahoe Basin Management Unit. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Townsend’s Big-eared bat Existing Conditions

Townsend’s big-eared bat ranges “throughout western North America from British Columbia to the central Mexican highlands, with isolated populations reaching east in the United States to the Ozarks and Appalachia” (summarized in Pierson and Rainey 1998), and occurs “in a variety of habitats, including desert scrub, sagebrush, chaparral, and deciduous and coniferous forests" (summarized in Minor and Stokes 2005). The historic and current range in California is not understood with great accuracy or precision.

This species may occur from sea level to over 10,000 feet (summarized in Kunz and Martin 1982, Gellman and Zielinski 1996, Fellers and Pierson 2002). Caves or cave analogues (e.g., abandoned mines and buildings, and lava tubes) are typically used for roosting (Graham 1966, Barbour and Davis 1969, Kunz and Martin 1982) though roosting in tree hollows has been reported in coastal California habitats (Gellman and Zielinski 1996, Fellers and Pierson 2002). Roost searches are the most efficient survey method as Townsend's big-eared bats are not readily detected by mist-net or acoustic surveys (Miner and Stokes 2005). This species, rather than roosting in crevices like many other species of bat, roosts only out in the open on walls and ceilings where it is easily detected (Pierson and Rainey 1998). Care must be taken near roosts as this species is particularly sensitive to disturbance and may abandon roost sites after even the slightest disturbance (Graham 1966, Barbour and Davis 1969, Pierson and Rainey 1998, Minor and Stokes 2005). No roosts are known on the LTBMU; the nearest known roosts are located over 50 miles from the wildlife analysis area in the Sierra Nevada foothills (Pierson and Rainey 1998). Surveys were not conducted for this project, but two detections of this species (one at Blackwood Canyon and one within the wildlife analysis area at Cookhouse Meadow) are known within the Lake Tahoe basin (Julie Roth – Wildlife Biologist, personal communication 2008).

This species is a moth specialist but also feeds on a variety of butterflies, skipper butterflies, and moth-butterflies (Pierson and Rainey 1998). Townsend's big-eared bats frequently forage along forested edges over vegetation and require access to open water (USDA FS 2001). Although this species occurs in a wide variety of habitats and is fairly adaptable regarding its foraging requirements, its distribution appears constrained primarily by the availability of suitable roosting sites and the degree of human disturbance at roosts.

The LTBMU contacted partner agencies, mining and spelunking-related organizations and agencies, universities, and historic databases in 2008 to identify caves and cave analogues that may be suitable Townsend's big-eared bat roost sites within the Lake Tahoe basin. Site visits to determine the suitability of these sites were completed during early summer 2008. Surveys for bat occupancy are ongoing.

For purposes of this analysis, and because roosting habitat for Townsend's big-eared bat is site-specific and not meaningfully described in terms of acres, roosting habitat will be discussed in terms of sites (or potential sites) rather than numbers of acres. Similarly, because foraging habitat for this species is closely associated with the proximity of suitable roosting habitat and not well described by vegetation types or strata, foraging habitat will be discussed in terms of general changes to non-urban areas within the wildlife analysis area.

To date, the Mountain Top (a.k.a. Gold Hill) mine is the only suitable cave or cave-analogue identified as potential habitat within the wildlife analysis area. The historic mine is located on a ridge top east of the Saxon Creek drainage, approximately 0.95 mile southeast of the project area at 9,000 feet elevation, and is only marginally suitable (a five foot by seven foot entrance leading to a 15 foot deep shaft). No Townsend's big-eared bats were detected at or near the historic mining site. Another potential habitat site, the Meiss cabin, a historic building located within the wildlife analysis area and approximately 4.4 miles southwest of the project area at 8,400 feet elevation, is frequently visited by recreational users and not occupied by this species. No other potential Townsend's big-eared bat roost sites are known or identified within the wildlife analysis area.

Townsend's Big-eared bat Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Wildland fire would continue to threaten this species habitat, including roost trees if local Townsend's big-eared bats are roosting in tree hollows as has been reported in coastal California habitats. Human disturbance and development would continue to restrict the potential use of caves or cave analogues by this species. Suitable Townsend's big-eared bat habitat would not be affected by this alternative. No direct or indirect effects would occur as a result of the no actionalternative.

Alternatives 2 and 3

Townsend's big-eared bats are sensitive to disturbance, particularly at roost sites. The sensitivity of this species to disturbance at roost sites logically reduces the potential for the action alternatives to affect roosts used by this species. Project activities are located in the WUI where human disturbance is typically greater than in areas located outside the WUI. All known cave or cave analogue sites within the wildlife analysis area were surveyed for the presence of this species, but no Townsend's big-eared bats were detected. Despite the lack of detections at potential roost sites, this species was detected at Cookhouse Meadow adjacent to the southernmost proposed treatment units for either action alternative. As this species is not reputed to fly long distances (i.e., "less than a few kilometers") from roosts, it is reasonable to presume that Townsend's big-eared bats may be roosting within the wildlife analysis area. This species may be using unidentified caves or analogues in cliffs (e.g., at Luther Spires or Round Lake), large talus fields, tree hollows, or other structures.

The potential to affect this species or its habitat is limited if Townsend's big-eared bats in the wildlife analysis area are roosting in mines, buildings, cliffs, or talus fields, because the proposed action does not include actions that would directly affect these sites. Disturbance-type effects could occur related to project implementation and may include displacement of individuals by equipment flushing an individual and changes in patterns of habitat use by avoidance of areas with ongoing project activities. Direct effects to individual bats would most likely occur during the morning or evening given the activity patterns of this species. Mortality of individual bats or effects to reproduction would not be expected as roost structures would not be affected. However, if this species is roosting in tree hollows as documented in coastal habitats, then effects to roost sites may occur. Tree hollows, like those reported by Gellman and Zielinski (1996) and Fellers and Pierson (2002), are most likely to occur in larger, more decadent trees, especially those with structural defects.

The action alternatives would focus on the removal of the small to medium size classes of trees, but some larger trees, including those that may provide habitat to this species, could be removed. The focus of treatment prescriptions and training of tree marking personnel to retain "wildlife" trees (i.e., generally larger trees that appear to provide structure for wildlife species such as cavities, nesting platforms, or foraging opportunities) moderate the risk of removal of potential Townsend's big-eared bat roosts. Removal of a roost tree or trees would be expected to cause affected bats to relocate to a new roost. As the availability of suitable roost trees is unknown, the effect of expulsion of individual bats is unknown, but could reasonably range from a temporary disturbance to mortality. Recruitment of new roosts would be likely to occur during the 15 years after treatment as retained large trees mature and may become decadent or experience structural defects.

The potential scope of effects would be reduced in Alternative 3, compared to Alternative 2, because fewer acres would be treated and fewer acres would be mechanically treated. The reduction in treatments acres proposed in Alternative 3 would reduce the number of days required to complete project implementation thus reducing potential direct disturbance effects to individual bats. Alternative 3 would also reduce the number of roost trees (if this species is using tree hollows for roosting) affected by thinning operations. Potential roost trees are expected to occur in the larger tree size classes, therefore, reductions in mechanically treated acres would be expected to reduce the number of large trees removed in Alternative 3 because of practical diameter limits imposed on hand thinning operations. Fewer potential roost trees would likely be removed in hand thinning operations where tree removal is generally limited to 14 inches dbh (live) and 20 inches dbh (dead).

Townsend's Big-eared bat Cumulative Effects

Alternative 1

No direct or indirect effects would occur; therefore no cumulative effects would occur.

Alternative 2

The proposed action, when combined with past, present, and reasonably foreseeable future actions is not expected to have a cumulative effect to Townsend's big-eared bat because caves and cave analogues most likely to provide roosting habitat for this species would retained across the landscape. The proposed action does not include actions that would contribute to alteration of the following types of potential roost sites: caves, mines, buildings, cliffs, or talus fields. If this species uses tree hollows for roosts, some roosts may be removed by project implementation, but a cumulative effect is not expected as the proposed action would occur in the WUI, where this species is less likely to roost because of human disturbance, and as suitable tree hollows are likely to occur in greater abundance in the area outside the WUI.

Alternative 3

Cumulative effects for Alternative 3 are the same as those for Alternative 2 except that the scope of effects is slightly reduced as fewer acres would be treated.

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore Fuel Reduction and Healthy Forest Restoration Project DEIS will have **No Effect** on the Townsend's Big-eared Bat.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore Fuel Reduction and Healthy Forest Restoration Project DEIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the Townsend's Big-eared Bat. Rationale:

- Disturbance-type effects (e.g., individual Townsend's big-eared bats avoiding project equipment) may occur during implementation
- The proposed action does not include actions that would alter potential roosts in caves, mines, buildings, cliffs, or talus fields
- The proposed action would likely remove tree hollow-type roosts, if this type of roost is used within the Lake Tahoe basin
- Tree hollow-type roosts would remain relatively abundant within the wildlife analysis area after project implementation

Bald Eagle

The U.S. Fish and Wildlife Service announced intent to de-list the bald eagle (*Haliaeetus leucocephalus*), formerly federally-listed as a threatened species, on June 28, 2007. The bald eagle was federally de-listed on August 8, 2007, and then placed on the Region 5 Regional Forester's sensitive species list. The bald eagle will be analyzed here as a Forest Service sensitive (S) species. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b). The bald eagle is also a Tahoe Regional Planning Agency Special Interest Species (SIS). Please refer to the Tahoe Regional Planning Agency Impact Analysis for this project for further discussion of this species in regards to its SIS status.

The Recovery Plan for the Pacific Bald Eagle (USFWS 1986) states that the main threats to this species in Zone 28 (Sierra Nevada Mountains) are disturbance at wintering grounds and loss of potential nest habitat to logging or development. The Plan's proposed management directions are maintenance of winter habitat and evaluation of potential reintroduction/expansion of 'breeders'. The most urgent site-specific task identified for the Forest Service in Zone 28 (task 1.3211) is to prohibit logging of known nest, perch, or winter roost trees (USFWS 1986).

Bald eagle Existing Conditions

Bald eagles occur throughout most of North America and have undergone large population fluctuations over the past two centuries (Buehler 2000, Murphy and Knopp 2000, USDA FS 2001). This species occurs and winters throughout California, except in desert areas. Migratory individuals from north and northeast of the State arrive between mid-October and December and remain until March or early April. Most bald eagle breeding in California occurs in the northern counties (Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties), typically at low elevations; breeding in the high Sierra Nevada is rare (USDA FS 2001). Bald eagles have been recorded in the Lake Tahoe basin as far back as 1874 and occur year-round; bald eagle numbers peak during the fall and winter, corresponding with Kokanee salmon spawning activity (Murphy and Knopp 2000). This species has been known to breed at Marlette Lake on the east side of Lake Tahoe and at Emerald Bay within the wildlife analysis area.

The LTBMU manages approximately 370 acres of the Taylor Creek and Tallac Creek wetlands and meadows north of Highway 89 as bald eagle wintering habitat from October 15 through March 15 annually. These wetlands and adjacent uplands are also managed for developed recreation (e.g., Taylor Creek visitor's center and Baldwin and Kiva beaches), and are visited by over 800,000 visitors each year (Don Lane – LTBMU recreation specialist, pers. comm.2008), most of them during the late spring, summer, and early fall. Suitable habitats exist in close proximity to these intensive recreation sites and are identified by signs and fences.

Bald eagles require open water with juxtaposed mature trees or steep cliffs for nesting, perching, foraging, and roosting (Bent 1961 in Murphy and Knopp 2000). This species typically perches in "large, robustly limbed trees, on snags, on broken topped trees, or on rocks near water" (Peterson 1986 and Laves and Romsos 1998 in Murphy and Knopp 2000). Bald eagles wintering in the Lake Tahoe basin have been documented to use "only dominant trees (mostly snags) within the shore zone to perch" (Laves and Romsos 1998 in Murphy and Knopp 2000). 96 percent of the perch sites identified by Laves and Romsos (1998) were located within 0.25 miles of a large, open body of water. Late successional Jeffrey pine vegetation was used most frequently for perching and montane chaparral the least (Ibid). Habitat and perch sites (Laves and Romsos 1998) identified in the Lake Tahoe basin indicate that local bald eagles prefer late successional stands (particularly Jeffrey pine) and trees that are larger in diameter and taller than the dominant tree canopy (particularly trees greater than 40 inches dbh, greater than 98 feet tall, and dead topped trees with robust, open branch structures). Perches function as resting, preening, foraging, and feeding sites for bald eagles.

Roost trees are perches where one or more bald eagles rest at night and may occur long distances from open water bodies. Roost trees are similar in structure compared to perch trees; “dominant trees that have open and robust branches, are sometimes defoliated (i.e., snags), are protected from prevailing winds, and are typically far from human development” (Anthony et al. 1982 in Murphy and Knopp 2000). Roost trees have not been identified in the Lake Tahoe basin though stands that meet the requirements of this species for roosting may be present.

Bald eagles are generalist carnivores; they are opportunistic predators and scavengers (Detrich 1986 and Jurek 1988, as summarized in USDA FS 2001). Common prey items include fish, waterfowl, jackrabbits, and carrion (Zeiner et al. 1990 in USDA FS 2001). This species may feed gregariously, on abundant prey such as spawning fish, or individually (Ibid). Foraging often occurs from diurnal perches, which are located high in the canopy, near water, and with a good view of the surrounding area.

Nest trees are “typically established in large, dominant live trees with open branch work and are often located within 1.6 km [0.96 miles] of open water” (Murphy and Knopp 2000). Nest trees must be sturdy to support the large, heavy stick nests built by this species at or just below the tree canopy (Ibid). Nests are located most frequently in stands with less than 40 percent canopy cover (Call 1978 in Murphy and Knopp 2000). Nest trees in the Lake Tahoe basin are located in close proximity to open water (<656 feet) and away from developed shorelines (>1.5 miles) (Murphy and Knopp 2000). Bald eagles are known to use the Jeffrey pine vegetation type for nesting in the Lake Tahoe basin, therefore, the Jeffrey pine vegetation type will be considered high capability (5S, 5P, and 6) and moderate capability (4S, 4P, and 4D) nesting habitat for the purposes of this analysis. Moderate to high capability nesting habitat is located within 1.0 mile of open water as described above.

Bald eagles are also known to use the Jeffrey pine vegetation type for perching in the Lake Tahoe basin, despite the CWHR model prediction that this vegetation type would normally provide low perching capability for this species. The Jeffrey pine vegetation type will be considered high capability (5S, 5P, 5M, and 6) and moderate capability (4S, 4P, and 4M) perching habitat for the purposes of this analysis. Moderate to high capability perching habitat is located within 0.25 mile of open water as described above.

The Jeffrey pine vegetation type is known to be used by bald eagles for foraging in the Lake Tahoe basin, despite the CWHR model prediction that this vegetation type would normally provide low foraging capability for this species. Therefore, the Jeffrey pine vegetation type will be considered high capability (5S, 5P, 5M, and 6) and moderate capability (4S, 4P, and 4M) foraging habitat for the purposes of this analysis. Moderate to high capability foraging habitat is located within 0.25 mile of open water as described above.

Estimated acres of high and moderate capability nesting habitat, acres of high and moderate capability perching habitat, and acres of high and moderate capability foraging habitat currently present for bald eagle within the wildlife analysis area are given in Table 3-76.

Table 3-76. Existing acres of high and moderate capability bald eagle habitat within the project wildlife analysis area

Habitat Capability	Nesting Habitat	Perching Habitat	Foraging Habitat
High	134	333	2,394
Moderate	3,084	1,334	2,485
Total	3,218	1,667	4,879

Bald eagles are usually monogamous and pair for life, though re-pairing may occur if either of the pair dies. The mating season varies by latitude, and in the Lake Tahoe basin pair initiation begins in January and egg-laying occurs in early May. Incubation lasts for approximately 35 days, and hatching occurs in mid-June. Both parents provide care for the nestlings for approximately 10-12 weeks. Juveniles fledge in late August and depend on the nest site for 4-11 weeks following the first flight. Bald eagles require 4-5 years to reach sexual maturity and full adult plumage. Dispersal distances can be substantial; this species often disperses several hundred miles from the natal site. Females tend to disperse farther than males. Breeding home ranges vary substantially by location from 58 acres in Alaska to 24 square miles in Arizona. Migration distances of up to 2,756 km have been recorded. Fidelity to wintering grounds is strong (summarized in USDA FS 2001).

Bald eagle surveys for this project include mid-winter counts and breeding season nest surveys conducted from 2006 through 2008. Approximately 16,744 acres were surveyed for mid-winter count and nest surveys for bald eagles in the Lake Tahoe basin (5,104 acres were surveyed within the wildlife analysis area) in 2006 and 2007. In addition, a long-term bald eagle count and nest survey history (20+ years) exists in the wildlife analysis area. The results of the project-specific, relevant concurrent and historic surveys are considered in this analysis.

The LTBMU hosts annual mid-winter bald eagle counts (25th annual count in 2008) in coordination with partner agencies and the University of Santa Cruz, Predatory Bird Research Group (PBRG). Results from counts contribute to statewide and national population assessments. Volunteers and agency personnel conduct the one-day, 3-hour long, mid-winter count, typically during the first two weeks of January, from 26 fixed locations around Lake Tahoe and Fallen Leaf Lake (11 locations are within the wildlife analysis area) following the PBRG survey protocol. Individual bald eagles recorded are differentiated (to reduce the risk of over- or under-counting) after the survey based on direction of flight and time of observation. Up to 19 individual bald eagles have been recorded during the count and as many as eight eagles have been detected in one location (Sugar Pine Point State Park, 2005). The spatial distribution of detections varies annually (e.g., most of the eagles may be detected along the south shore of Lake Tahoe one year and on the north shore the next). The results of counts from the past decade are presented below (Table 3-77).

Table 3-77. Results of bald eagle mid-winter counts in the Lake Tahoe basin, 1999-2008

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total number of bald eagles detected	12	8	15	14	10	12	18	7	9	10

The LTBMU also conducts annual bald eagle nesting surveys in conjunction with osprey nesting surveys and in cooperation with California State Parks and Nevada State Parks, who also monitor the eagle nests. The nests are visited at least five times annually, and often more frequently. There are two nesting territories in the Basin, one at Marlette Lake and the other at Emerald Bay. The Emerald Bay territory is active and fledges young more frequently than the Marlette Lake territory. Nesting activity within the territories varied annually, as has fledging, over the past decade (Table 3-78).

Table 3-78. Number of active bald eagle nests and juveniles fledged in the Lake Tahoe basin 1998-2007

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Number of active nests	1	0	0	0	1	1	0	1	1	1
Number of juveniles fledged	2	0	0	0	2	0	0	1	2	2

Bald Eagle Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Overstocking and conifer encroachment in the Taylor-Tallac meadows would continue. Wildland fire would continue to threaten this species habitat, as demonstrated by multiple recent fires within the Taylor-Tallac meadows. Bald eagles would continue to use suitable perching and foraging habitats in the Taylor-Tallac area and nesting habitat at Emerald Bay. Suitable bald eagle habitats would not be affected by this alternative. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Bald eagles are sensitive to disturbance and generally avoid urbanized areas and areas with intensive human disturbance in the Lake Tahoe basin. Exceptions to human avoidance are known to occur along the shores of large lakes (e.g., Lake Tahoe, Fallen Leaf Lake, and Lower Echo Lake) and along major waterways (e.g., Upper Truckee River). Individual eagles often pass through, but typically do not linger within, these disturbed areas en route to higher quality habitats. Nesting habitats are located in more remote stands, none of which would be treated in either action alternative, while perching and foraging habitats may be located in closer proximity to disturbance. For example, bald eagles foraging in the Taylor-Tallac wetlands are separated from intensive recreational-use by a creek and less than 0.25 mile of wetland habitat. Alternatives 2 and 3 would treat stands located adjacent to or within suitable habitats, including travel corridors and may directly affect bald eagles present during implementation. Direct effects to individual eagles may include displacement of individuals from equipment or people flushing an individual or changes in patterns of habitat use to avoid areas with ongoing project activities. Direct effects to bald eagles would be minimized in areas with regular observed use such as Taylor-Tallac wetlands and meadows through implementation of LOPs. Effects to bald eagle reproduction are not expected as nest stands are not located within approximately 1.25 miles of treatment stands for either action alternative and are further spatially separated from project activities by the 300-foot tall lateral moraine (ridge) on the southern side of Emerald Bay. Survival is unlikely to be affected as individuals of this species would be expected to easily avoid project activities.

The estimated number of acres of high and moderate capability bald eagle nesting, perching, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-79. Total existing acres of these habitats within the wildlife analysis area are included for comparison. High and moderate capability bald eagle nesting habitat would increase by an estimated 91 acres (3%) in Alternative 2 and by 32 acres (1%) in Alternative 3. While thinning activities would not create the very large, canopy-dominating trees used for bald eagle nesting, improvements to stand health where large tree size classes exist would contribute to the persistence and maturation of trees and stands that may support nesting in the future given favorable conditions such as proximity to permanent water and foraging, and limited disturbance. Predicted changes in nesting habitat are likely to be the result of increased mean tree size within treated stands. The gain in bald eagle nesting habitat is consistent with direction from the Recovery Plan for the Pacific Bald Eagle (USFWS 1986), which states that the main threats to this species in this part of the Sierra Nevada Mountains, including the wildlife analysis area, are disturbance at wintering grounds and loss of potential nest habitat to logging or development.

High and moderate capability perching and foraging habitat would increase slightly in either action alternative as shown in Table 3-79. Perch and foraging trees would generally be retained throughout treatment stands as these trees are typically among the largest in height and diameter, and thinning activities would focus on much smaller size classes. Recreational access within thinned stands would be addressed through the strategic placement of barriers at access points such as parking lots and along roads and trails to minimize the potential for user-created trails and associated disturbance, in keeping with the recovery plan's prioritization of managing disturbance at wintering grounds. The Taylor-Tallac wetlands and adjacent uplands (i.e., back-beach swales, meadows, aspen stands, and upland conifer forest) are expected to provide an increased quantity and quality of bald eagle habitats following implementation of either action alternative. Known nest, perch, or winter roost trees would be retained. Alternatives 2 and 3 would affect bald eagle habitats similarly; Alternative 2 would result in slightly more nesting habitat; Alternative 3 would result in slightly more foraging habitat and slightly less potential for disturbance of individuals as fewer acres would be treated

Table 3-79. Estimated acres of high and moderate capability bald eagle habitat within the project area before and after implementation of Alternatives 2 or 3 in comparison to the wildlife analysis area

	Habitat Capability	Nesting Habitat		Perching Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	134 / 612	+478	72 / 168	+96	72 / 168	+96
	Moderate	507 / 120	-387	135 / 63	-72	374 / 458	+84
	Total	641 / 732	+91	207 / 231	+24	446 / 626	+180
Alternative 3	High	134 / 546	+412	94 / 190	+96	94 / 190	+96
	Moderate	479 / 99	-380	116 / 44	-72	332 / 421	+89
	Total	613 / 600	+32	210 / 234	+24	426 / 611	+185
Wildlife Analysis Area	High	134		333		2,394	
	Moderate	3,084		1,334		2,485	
	Total	3,218		1,667		4,879	

Bald Eagle Cumulative Effects

Alternative 1

No direct or indirect effects would occur in the No Action alternative; therefore no cumulative effects would occur.

Alternative 2

The proposed action, when combined with past, present, and reasonably foreseeable future actions is not expected to have a cumulative effect to bald eagle because effects to survival are unlikely and effects to reproduction are not expected to occur. No cumulative effect to bald eagle habitat is expected due to the slight increases in suitable habitats anticipated from implementation. The Taylor Creek Visitor Center may be revised in the reasonably foreseeable future opposite the Taylor Creek marsh used by this species and is be expected to manage the intensive recreation occurring in the area, addressing human disturbance. No cumulative effect from the proposed action, when combined with the potential revision of the Taylor Creek Visitor Center, is expected.

Alternative 3

The cumulative effect of Alternative 3 is expected to be the same as that for Alternative 2. Alternative 2 would result in slightly more (59 acres) nesting habitat, whereas Alternative 3 would result in slightly more (5 acres) foraging habitat and slightly less potential for disturbance of individuals as fewer acres would be treated (3,371 acres in Alternative 2 and 3,653 acres in Alternative 3).

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the Bald Eagle.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore Fuel Reduction and Healthy Forest Restoration Project DEIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the Bald Eagle rationale:

- Disturbance-type effects (e.g., individual bald eagles avoiding project equipment) may occur during implementation
- Effects to reproduction are not expected and nest stands would not be treated
- Slight increases in nesting, perching, and foraging habitat are predicted following implementation
- The proposed action is consistent with the Recovery Plan for the Pacific Bald Eagle

Northern Goshawk

The northern goshawk (*Accipiter gentilis*) is a Forest Service Sensitive (S) and Management Indicator Species (MIS) and a Tahoe Regional Planning Agency Special Interest Species (SIS) on the Lake Tahoe Basin Management Unit. Please refer to the Management Indicator Species Report and Tahoe Regional Planning Agency Impact Analysis for this project for further discussion of this species in regards to its MIS and SIS status. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Northern Goshawk Existing Conditions

Northern goshawks occupy boreal and temperate forests worldwide throughout the arctic and boreal forest zone (Squires and Reynolds 1997). This broad range of forested communities includes mixed conifer, true fir, montane riparian, Jeffrey pine, ponderosa pine, and lodgepole pine forests (USDA FS 2004a). Within California, this species occurs in the Sierra Nevada, Klamath, Cascade, Inyo-White, Siskiyou, and Warner Mountains, and the North Coast Ranges. Goshawks may also inhabit suitable habitats in the Transverse Ranges and other mountainous areas in southern California (Zeiner et al. 1990 and Murphy et al. 2000b).

Northern goshawk nesting habitat at the nest stand scale has consistently greater canopy cover, greater basal area, greater numbers of large diameter trees, fewer small diameter trees, less understory cover, and gentle to moderate slopes relative to random samples of non-used sites (USDA FS 2001). McGrath et al. (2003) found that goshawks in the Interior Northwest nested, at the 0.4 acre (one hectare) scale, on the lower 1/3 or bottom of north facing slopes in stands characterized by relatively higher basal area, higher quadratic mean diameter, greater canopy closure, and greater live stem densities, compared to random sites. Goshawks nesting in the relatively open-canopied and drier stands found on the eastern slopes of the Sierra Nevada in the Inyo National Forest selected nest stands with a mean canopy closure of 29 percent (Hargis et al. 1994). Variability in the structural characteristics of nest stands between studies appears to be related to differences in vegetation type and geographic region.

Within the Lake Tahoe region of the Sierra Nevada, Keane (1999) found that nest-site areas (0.25 acre) were characterized by high canopy closure (mean=70.4%,), high densities of live trees in >24-40 inch (mean=22.1 trees/acre) and >40 inch dbh classes, high densities of dead trees in the >24-40 dbh inch class, low densities of 2-12 inch dbh live trees, and low shrub/sapling and ground cover (mean=9.9%). No difference in slope or aspect was detected for nest sites (Ibid.). Later surveys of 42 goshawk nest stands in the Lake Tahoe basin, conducted by LTBMU biologists in 2004 and 2005, measured canopy closure (mean=79%, range=51-97%), live tree diameter (mean=19.6 inches, range=13.6-45.6 inches), shrub cover (mean=9%, range=0-57%), slope (mean=17 degrees, range=2-41 degrees), and slope aspect (north-facing=24%, east-facing=36%, south-facing=31%, and west-facing=10%) (unpubl. data).

TRPA (unpubl. 2000) and the LTBMU (unpubl. 2006) developed spatially explicit goshawk nesting habitat models using local goshawk nest stand data to facilitate improved agency understanding and management of goshawk nesting habitat in the Lake Tahoe basin. The TRPA model incorporates vegetation (type, size, and canopy cover), slope, aspect, elevation, distance to streams, and land use types. The similar LTBMU model incorporates the characteristics used in the TRPA model and terrestrial ecological unit inventory (TEUI 2004) vegetation data (land type association, potential natural vegetation type, and normalized difference vegetation indices), relative position on slope, and road infrastructure. The TRPA model correctly classifies 89 percent of known goshawk nests (n=85) within moderately or highly suitable habitat. Nesting habitat characteristics of the more recent LTBMU model were weighted to achieve a correct classification ratio of 99 percent (79% high, 20% moderate, and 1% low habitat suitability). These models appear effective in predicting goshawk nesting habitat for the time frame during which the remotely sensed data utilized is valid.

Canopy cover and CWHR forest vegetation types and strata are the primary metrics used for the northern goshawk in this analysis. CWHR is useful in modeling predicted changes in pre-and post-treatment stand density and size classes in relation to habitat suitability for wildlife species such as northern goshawk. Remote sensing does not accurately detect levels of snags or coarse woody debris, nor does the CWHR model include a vegetation category for these types of information. These types of data were collected at forest inventory and analysis (FIA) plots within the proposed action area and changes resulting from the proposed alternatives are modeled by prescription. In summary, snag and coarse woody debris abundance are incorporated in the project design features and addressed through pre-treatment surveys, treatment prescriptions, and implementation monitoring.

Nesting behavior, including courtship and nest initiation, begins mid-February to early March. The average incubation period is approximately 33 days and the nestling period typically extends from early June through early July, with most young fledged by mid-July. The post-fledging dependency period extends until mid/late August (Woodbridge and Hargis 2006).

Goshawks are well adapted to foraging in forested habitats, but are also able to ambush prey in open habitats (summarized in Squires and Reynolds 1997). Moderately dense, mature conifer forests are generally the preferred foraging habitat (Ibid). However, goshawks also forage in a variety of other forest age-classes, structures and compositions, into openings, and along forest edges (summarized in Reynolds et al. 2006). In California, mature and old growth habitat (≥20.8 inches dbh, canopy closure ≥40%) were used, whereas open habitats such as meadows and early seral areas were avoided in mixed-conifer forests (Austin 1993). In Arizona, Beier and Drennan (1997) found that goshawks foraged in stands that had higher canopy closure, greater tree density, and a greater density of large trees (>16.2 inches dbh) than on contrast plots. Snags and logs are key components of goshawk foraging areas as they provide habitat for prey species (USDA FS 1988). Prey availability within suitable foraging habitats appears to be more important to habitat use than prey abundance for this species (Reynolds et al. 2006).

Northern goshawks are known to prey on over 50 species of birds and mammals throughout their western range (Graham et al. 1994). Prey size varies little between geographic regions (Boal and Mannan 1994). In the Lake Tahoe region, primary prey species include Douglas squirrel (*Tamiasciurus douglasii*), Steller's jay (*Cyanocitta stelleri*), northern flicker (*Colaptes auratus*), and ground squirrel (*Spermophilus* spp.). Other prey species include American robin (*Turdus migratorius*), blue grouse (*Dendragapus obscurus*), other woodpeckers, and other squirrels (Keane1999).

The estimated acres of high and moderate capability nesting habitat, acres of high and moderate capability perching habitat, and acres of high and moderate capability foraging habitat currently existing for northern goshawk within the wildlife analysis area are listed in Table 3-80.

Table 3-80. Existing acres of high and moderate capability northern goshawk habitat within the project wildlife analysis area

Habitat Capability	Nesting Habitat	Perching Habitat	Foraging Habitat
High	13,622	20,393	20,393
Moderate	3,806	30,451	37,641
Total	17,428	50,844	58,034

Goshawk habitat use and life history requirements may be discussed at spatial scales varying from the nest area (smallest) to the non-breeding home range (largest). The nest area (approximately 20-25 acres) includes one or more forest stands, the nest tree, and possibly several alternate nests. Nest areas may be occupied by breeding goshawks from mid-February until late September, and are the focus of all movements and activities associated with nesting. Goshawks may have multiple nest areas within their home range, and nest areas may be used intermittently for many years. Nest areas have relatively high canopy cover (typically greater than 50%) and a high density of large trees.

The protected activity center (PAC) includes 200 acres of the highest quality nesting habitat available, and the most recent nest site and alternate nests within a goshawk breeding territory as described in management direction for the forest (USDA FS 2004b). The size of the PACs corresponds with criteria reported by Woodbridge and Detrich (1994) such that territory occupancy rates of approximately 100% were associated with clusters of nest stands totaling 150-200 acres (USDA FS 2001). There are currently 32 northern goshawk PACs on the LTBMU.

The post-fledging family area (PFA) corresponds to the area (approximately 500 acres) used by the adults and young from the time when the young fledge until the young are no longer dependent on the adults for food. PFAs provide juveniles with cover from predators and sufficient prey to develop foraging skills prior to dispersal. PFAs typically include a variety of forest conditions and areas of high canopy cover (greater than 50%). The TRPA disturbance zone is based on a 0.5 mile radius (503 acre) around a known nest tree and is equivalent in scale to the PFA.

The home range increases in size from the breeding season to the non-breeding season and is generally larger for males than for females throughout the year. During the breeding season, the average home range of goshawks in the Lake Tahoe area was 6,745 acres for males and 5,040 acres for females. Non-breeding season home ranges averaged 23,448 acres for males and 13,888 acres for females (Keane 1999). Home ranges include areas with a greater proportion of larger tree size classes and higher density classes than that randomly available across the landscape. The home range includes the PFA, PAC, and nest areas. The area within the home range, but outside the PFA, is often referred to as the foraging area (Reynolds et al. 1992). Maintaining requisite habitat elements can be best accomplished by managing large tracts of forests as sustainable ecological units where forest successional processes are continually moving a number of stands, within the natural range of variability, through the late seral stages preferred by this species (Reynolds et al. 1992 and DeStefano et al. 1994).

Surveys for goshawks were conducted in the wildlife analysis area following the USFS, Region 5 Northern Goshawk Inventory and Monitoring Technical Guide protocol (Woodbridge and Hargis 2006) in 2006 and 2007. An estimated total 26,827 acres (approximately 24,269 acres for the South Shore project and an additional 2,558 acres for other projects) were surveyed for goshawk within the wildlife analysis area in 2006 and 2007. In addition, a long-term goshawk survey history (20+ years) exists in the wildlife analysis area. The results of the project-specific, relevant concurrent and historic surveys are considered in this analysis.

The northern goshawk territories assessment project conducted in 2004 and 2005 for the LTBMU, TRPA, and Nevada Division of Wildlife was completed in 2007. Goshawk territory occupancy, nesting, reproductive success, vegetation conditions, and human disturbance were examined at various spatial scales in the Lake Tahoe basin (Young and Morrison 2007). Goshawks are well known to be territorial and exhibit high site fidelity (Detrich and Woodbridge 1994 and Reynolds et al. 1994). Territory occupancy was used as an indicator of habitat quality based on Ideal Despotic Distribution (IDD) conceptual theory, in which territorial behavior causes the best territories to be occupied when population densities are low, and low quality territories to be occupied only when high quality territories are at high population densities (Fretwell and Lucas 1970). Young and Morrison (2007) identified frequently, moderately, and infrequently occupied territories throughout the Lake Tahoe basin (Table 3-80). It is important to note that goshawk PACs and territories do not correlate on a one-to-one basis. The territories currently recognized are based on retrospective examination of approximately 31 years (1977-2007) of surveys whereas goshawk PACs are delineated prospectively as nesting and/or occupancy are discovered. The prospective delineation of PACs is a conservative management approach. The Forest also follows a conservative approach in eliminating goshawk PACs, which in some cases results in multiple PACs within a single territory.

Fifteen northern goshawk PACs are currently established throughout the wildlife analysis area. A sixteenth, the North Angora goshawk PAC, was eliminated following the stand replacing Angora

Fire in June-July 2007; there was insufficient remaining suitable habitat to re-map this PAC. The Seneca Pond PAC was also affected by the Angora Fire and was re-mapped within the wildlife analysis area.

Northern goshawk PACs are delineated to include 200 acres of the best available nesting habitat as described in management direction for the forest (USDA FS 2001, USDA FS 2004). The total acreage included in goshawk PACs on the LTBMU varies as inclusions of "non-forest vegetation (such as brush and meadows) should not be counted as part of the 200 acres" (USDA FS 2004). All LTBMU goshawk PACs were remapped in 2008 to incorporate the most up-to-date detection, nest location, and land boundary information available. The amount of high and moderate capability nesting, perching, and foraging habitat within each PAC varies according to what is available, given existing conditions, on the forest. Table 3-81 summarizes existing PAC acreage (200 acres of forested habitat plus non-forest vegetation) and the estimated number of acres of high and moderate capability nesting, perching, and foraging habitat for each goshawk PAC within the wildlife analysis area.

Table 3-81. Existing acres of high and moderate capability habitat within northern goshawk PACs in the wildlife analysis area

Protected Activity Center	Territory	PAC Acres	Habitat Capability	Nesting Habitat	Perching Habitat	Foraging Habitat
Cascade	Spring Creek	200	High	139	154	154
			Moderate	0	39	39
			Total	139	193	193
Spring Creek	Spring Creek	200	High	192	192	192
			Moderate	0	0	0
			Total	192	192	192
Floating Island	Spring Creek	200	High	178	178	178
			Moderate	0	0	0
			Total	178	178	178
Tahoe Mountain	Tahoe Mountain	205	High	188	196	196
			Moderate	0	6	6
			Total	188	202	202
Seneca Pond	Angora 1	238	High	52	186	186
			Moderate	0	25	25
			Total	52	211	211
Big Meadow	Big Meadow	203	High	188	197	197
			Moderate	0	4	4
			Total	188	201	201
Round Lake	None	220	High	21	157	157
			Moderate	30	38	60
			Total	51	195	217
Upper Saxon Creek	Saxon Creek	204	High	44	68	68
			Moderate	118	128	136
			Total	162	196	204
Middle Saxon Creek	Saxon Creek	200	High	200	200	200
			Moderate	0	0	0
			Total	200	200	200
Lower Saxon Creek	Saxon Creek	201	High	160	182	182
			Moderate	0	19	19
			Total	160	201	201
Hellhole	Hellhole	203	High	193	193	193
			Moderate	0	9	9
			Total	193	202	202

Lower Trout Creek A	Cold Creek	230	High	93	169	169
			Moderate	0	60	60
			Total	93	229	229
Lower Trout Creek B	Cold Creek	203	High	179	179	179
			Moderate	0	23	23
			Total	179	202	202
Upper Cold Creek	Upper Cold Creek	204	High	95	158	158
			Moderate	0	44	44
			Total	95	202	202
High Meadows	High Meadows	218	High	1	27	27
			Moderate	92	120	171
			Total	93	147	198
Totals		3,129	High and Moderate	2,163	2,951	3,032

In summary, Table 3-82 provides the following information for each of the 15 goshawk PACs in the wildlife analysis area: 1) PAC name; 2) associated territory name; 3) nesting, fledging, and occupancy detected since 1977 (for years in which surveys were completed); 4) whether detections occurred in association with the PAC in the previous three breeding seasons (2005-2007); 5) relative occupancy (frequently, moderately, infrequently occupied) as an indicator of habitat quality (Young and Morrison 2007); and 6) whether a vegetation treatment is proposed within the PAC under Alternatives 2 or 3. A summary of whether goshawk activity was detected within the previous three years (USDA FS 2004, p.60) is presented in the table to highlight PACs with recent activity.

Table 3-82. Summary information for northern goshawk Protected Activity Centers within the wildlife analysis area

Protected Activity Center	Territory	Nesting, Fledging, and Occupancy Detected in PAC	Detection in PAC 2005-2007	Territory Occupancy	Treated in Alternative 2	Treated in Alternative 3
Cascade	Spring Creek	Original (but unconfirmed) nest in 1979, different nest confirmed in 1984, no known nests since; fledged 1 in 1984; detections in 1984, 2000, 2006, and 2007.	Yes	Frequent	Yes	Yes
Spring Creek	Spring Creek	Original nest in 1999 (reused in 2001), other nests in 2000, 2003 (reused in 2005), and 2004; fledged 2 in 2003 and 1 in 2004; detections in 1999-2006.	Yes	Frequent	Yes	Yes
Floating Island	Spring Creek	Original nest in 1997; fledged 1 in 1997; detections in 1997, 1999, and 2002.	No	Frequent	No	No
Tahoe Mountain	Tahoe Mountain	Original (but unconfirmed) nest in 1992, different (unconfirmed) nest in 1993, confirmed nest in 2003; no known fledging; detections in 1997 and 2002-2005.	Yes	Infrequent	Yes	Yes
Seneca Pond	Angora 1	No known nests; no known fledging; detection in 1993. This information is for the re-mapped PAC.	No	Infrequent	Yes	Yes
Big Meadow	Big Meadow	Original nest in 2003 (reused in 2004), alternate nest in 2003, different nest in 2007; fledged 3 in 2004, 2 in 2005 (no nest found), 1 in 2007; detections in 1990, 1992, 1998, 2000-2005, and 2007.	Yes	Moderate	No	No
Round Lake	None	No known nests; no known fledging; detection in 1992.	No	None	No	No
Upper Saxon Creek	Saxon Creek	Original nest in 1995; fledged 2; detections in 1995, 1998, 1999, 2003, and 2007.	Yes	Frequent	No	No
Middle Saxon Creek	Saxon Creek	Original nest in 1991, different nests in 1998 (reused 2002 and 2004), 2001, and 2005 (1 confirmed and 1 alternate nest); fledged 2 in 1998, 2001, and 2005; detections in 1991, 1994, 1997, and 2001-2006.	Yes	Frequent	Yes	No
Lower Saxon Creek	Saxon Creek	Original nest in 1992, different nest in 1993; no known fledging; detections in 1992-1993, 2003 and 2005.	Yes	Frequent	Yes	Yes
Hellhole	Hellhole	Original nest in 1992, different nests in 1998 (reused in 2001), 1999, and 2003; no known fledging; detections in 1992, 1998-1999, and 2001-2005.	Yes	Frequent	Yes	Yes
Lower Trout Creek A	Cold Creek	Original (unconfirmed) nest in 1981; 2 fledglings in 1982 (but no nest found); detections in 1982 and 2002.	No	Infrequent	Yes	Yes

Lower Trout Creek B	Cold Creek	Original nest in 1992, different nests in 2002 (2 unconfirmed nests) and 2003; no fledging known; detections in 1992, 1998, and 2002-2007.	Yes	Infrequent	Yes	No
Upper Cold Creek	Upper Cold Creek	Original nest (and 2 alternate nests) in 2002, different (unconfirmed) nests in 2003 and 2005; fledged 3 in 1999 (no nest found); detections in 1999, 2002-2006.	Yes	Moderate	No	No
High Meadows	High Meadows	Original nest in 2004; 1 fledged in 2004; detections in 2003-2007. Large tree die-off prompted re-mapping of PAC in 2007.	Yes	Frequent	No	No

Northern Goshawk Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Within PACs, understory and mid-story vegetation would continue to increase in density, reducing habitat suitability and increasing risk to forest health. Moderate to very high risk of stand replacing fire would continue. While there are consequences of inaction, the No Action alternative would not affect goshawks or their habitats. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Goshawks tend to be sensitive to disturbance and generally avoid urban areas and portions of the WUI that are most impacted by ongoing human disturbance. Exceptions exist, such as a nest built immediately adjacent to a trail that receives very intensive recreational use on Saxon Creek, however, most goshawk activity centers in the Lake Tahoe basin have been detected in less-disturbed suitable habitats.

Protection of goshawks and goshawk habitat within nest stands are addressed in the project design features by limited operating periods, identification of nest trees, and nesting habitat-specific treatment prescriptions, which are expected to reduce the risk of adverse effects of either direct mortality of individuals or abandonment of the nest stand. Similarly, at the PAC spatial scale, project design features are expected to minimize potential adverse effects to goshawks and their habitat during implementation. Effects within each PAC in the wildlife analysis area are described in detail and summarized below.

Goshawk habitat use is divided into three roughly concentric areas, with the nest and associated PAC as the center area of primary importance and the area most sensitive to disturbance, where LOPs are applied. Outside of the PAC is the larger post-fledging family area (PFA), equivalent to the TRPA goshawk disturbance zone based on a 0.5 mile radius (503 acre) around a known nest tree. LOPs are not applied at the PFA, but goshawk habitat prescriptions would be applied to retain greater stand density and CWD unless the PFA overlaps an urban core area. The third, largest, and outermost habitat area is the home range, where neither LOPs nor goshawk habitat prescriptions would be applied. Direct disturbance is of most consequence at the nest site and within the PAC, decreases moving outward into the PFA area, and is of least consequence in the much larger home range area. Direct effects are more likely to occur at the PFA scale, because a larger area is affected by vegetation treatments, but potential effects would be smaller in magnitude, because PFA areas are considered to be less important in meeting the life requirements of this highly mobile species. Similarly, effects are most likely to occur at the largest scale of the home range, where more acres would be treated, but would be of the least consequence to the species.

Long term trends in vegetation structure, composition, and distribution at the PAC and PFA scales following implementation of Alternatives 2 or 3 are expected to benefit goshawks and their nesting habitat since the treatment prescription is designed to result in suitable nesting habitat or the development of suitable nesting habitat. Treatments would occur within the PFA/TRPA disturbance zone in each of the action alternatives (1,924 acres in Alternative 2 and 1,623 acres in Alternative 3). Effects within the TRPA disturbance zone are discussed further in the TRPA Wildlife Report, and incorporated here by reference.

Alternative 3 reduces the risk of adverse effects to goshawks and their habitat to a greater degree than Alternative 2, as fewer nest stands, PACs, and acres within PFAs and home ranges would be treated and fewer acres would be mechanically thinned. Effects of initial reduction of suitable goshawk habitat would be expected from disturbance-type effects of flushing of an individual in response to the operation of equipment during implementation. Effects would be expected to transition toward habitat maturation of the growth of a stand toward desired conditions more beneficial to goshawks over time. Similar to expectations described in the Northern Goshawk Nesting Territory Assessment, project implementation is expected to directly and indirectly benefit goshawks and their habitat in the long term.

The estimated number of acres of high and moderate capability goshawk nesting, perching, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-83. Total existing acres of these habitats within the wildlife analysis area are included for comparison. Alternatives 2 and 3 would reduce the amount of high and moderate capability goshawk nesting habitat available in the wildlife analysis area by an estimated 18 percent and 16 percent, respectively. More high than moderate capability nesting habitat would be reduced over the short term in both alternatives. Negligible changes in perching and foraging habitats would occur for either alternative, although approximately 1.6 percent and 1.4 percent of high capability perching and foraging habitats in the wildlife analysis area would be converted from high to moderate capability habitats, respectively. Fine scale habitat fragmentation would result from implementation of either action alternative due to reduction in stand area, reduction in interior area, changes in stand edge, or changes in insularity. Fine scale habitat fragmentation would occur during implementation as equipment and operations cause higher than background-level disturbance making portions of the wildlife analysis area temporarily unsuitable. The effect of this type of fragmentation on individual goshawks would be minimized by treatment schedules.

Coarse scale nesting habitat fragmentation would increase in either action alternative as high and moderate capability nesting habitats would be reduced. However, the increase in coarse scale fragmentation is expected to be slight and focused on urban areas, which are of the lowest value to goshawk reproduction because of the following:

- project design features would reduce potential effects to habitats within PACs;
- multiple PACs exist for the Saxon Creek, Spring Creek, and Trout Creek territories; and
- the majority of treatments would occur in the WUI defense zone (around the urban core) and not affect surrounding suitable habitats located outside the WUI.

Coarse scale perching and foraging habitat fragmentation is not expected for either action alternative. Connectivity between large tracts of high capability habitats (e.g., lower and mid-elevation slopes of the Freel Peak massif and the Upper Truckee River watershed) would be retained in either action alternative. Habitat connectivity at the landscape scale is expected to be preserved at a level similar to, but slightly less than, the existing condition.

Table 3-83. Estimated acres of high and moderate capability goshawk habitat within the project area before and after implementation of Alternatives 2 and 3, with comparison to the wildlife analysis area

	Habitat Capability	Nesting Habitat		Perching Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	6,191 / 3,687	-2,504	7,260 / 6,355	-905	7,260 / 6,355	-905
	Moderate	885 / 265	-620	2,541 / 3,404	+863	2,754 / 3,662	+908
	Total	7,076 / 3,952	-3,124	9,801 / 9,759	-42	10,014 / 10,017	+3
Alternative 3	High	5,668 / 3,479	-2,189	6,736 / 5,951	-785	6,736 / 5,951	-785
	Moderate	906 / 267	-639	2,529 / 3,264	+735	2,738 / 3,525	+787
	Total	6,574 / 3,746	-2,828	9,265 / 9,215	-50	9,474 / 9,476	+2
Wildlife Analysis Area	High	13,622		20,393		20,393	
	Moderate	3,806		30,451		37,641	
	Total	17,428		50,844		58,034	

The numbers of acres of treatments within current goshawk PACs in the wildlife analysis area are presented in Table 3-84, by treatment type and alternative. Alternative 2 would treat approximately 42 percent of PAC acres (33 percent mechanically and 9 percent by hand) in the wildlife analysis area. Alternative 3 would avoid mechanical treatments in PACs where possible: treatments were converted to hand thinning or eliminated based on stand conditions and predicted fire behavior. Alternative 3 would reduce mechanical treatments in PACs by 527 acres, increase hand treatments by 173 acres, and reduce total treatments by 353 acres. Alternative 3 would treat approximately 31 percent of PAC acres (16 percent mechanically and 15 percent by hand) in the wildlife analysis area.

Table 3-84. Acres of treatments within current goshawk PACs in the wildlife analysis area by treatment type and alternative

Protected Activity Center	PAC Acres	Mechanical		Hand		Total	
		Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Cascade	200	196	102	4	93	200	196
Spring Creek	200	20	0	49	69	69	69
Floating Island	200	0	0	0	0	0	0
Tahoe Mountain	205	201	129	4	76	205	205
Seneca Pond	238	216	150	2	35	218	185
Big Meadow	203	0	0	0	0	0	0
Round Lake	220	0	0	0	0	0	0
Upper Saxon Creek	204	0	0	0	0	0	0
Middle Saxon Creek	200	0	0	17	0	17	0
Lower Saxon Creek	201	21	9	173	190	194	199
Hellhole	203	83	68	41	0	124	68
Lower Trout Creek A	230	205	45	0	0	205	45
Lower Trout Creek B	203	88	0	0	0	88	0
Upper Cold Creek	204	0	0	0	0	0	0
High Meadows	218	0	0	0	0	0	0
Totals	3,129	1,030	503	290	463	1,320	967

Following management direction from the 2004 Framework, acres would be added to PACs where mechanical treatments are proposed except as described below (Table 3-85). Added acres are comparable in quality to those that would be mechanically treated. No acres would be added to the Cascade or Spring Creek PACs because only one goshawk territory exists within the Cascade, Spring Creek, and Floating Island PACs as described by the Northern Goshawk Nesting Territory Assessment. For the same reason, no acres would be added to the Lower Saxon Creek PAC (one territory within the Lower, Middle, and Upper Saxon Creek PACs) or the Lower Trout Creek A or B PACs (one territory within two PACs). An equivalent number of acres to those mechanically treated would not be added to the Seneca Pond PAC because additional acres of comparable quality do not exist in proximity to the PAC due to the Angora Fire. The Seneca Pond PAC was remapped after the Angora Fire and is surrounded by the burned area, granite slopes of Echo Summit, Highway 50, and North Upper Truckee neighborhoods. Fewer acres would be added to PACs in Alternative 3 as fewer acres would be mechanically treated.

Table 3-85. Acres added to current goshawk PACs in the wildlife analysis area as mitigation for mechanical treatments within these land allocations by action alternative

Protected Activity Center	Current PAC Acres	Mechanical		Proposed Additional Acres		Total Proposed PAC Acreage	
		Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Cascade	200	196	102	0	0	200	200
Spring Creek	200	20	0	0	0	200	200
Floating Island	200	0	0	0	0	200	200
Tahoe Mountain	205	201	129	201	129	406	334
Seneca Pond	238	216	150	23	23	261	261
Big Meadow	203	0	0	0	0	203	203
Round Lake	220	0	0	0	0	220	220
Upper Saxon Creek	204	0	0	0	0	204	204
Middle Saxon Creek	200	0	0	0	0	200	200
Lower Saxon Creek	201	21	9	0	0	201	201
Hellhole	203	83	68	83	68	286	271
Lower Trout Creek A	230	205	45	0	0	230	230
Lower Trout Creek B	203	88	0	0	0	203	203
Upper Cold Creek	204	0	0	0	0	204	204
High Meadows	218	0	0	0	0	218	218
Totals	3,129	1,030	503	307	220	3,436	3,349

Northern goshawk PACs were remapped, including additional proposed acreages, for each alternative. Acres of high and moderate capability nesting, perching, and foraging habitat within current and remapped PACs are shown below in Table 3-86, by alternative (figures shown for alternatives are post-implementation). Acres of habitat for existing PACs were estimated using remotely sensed data whereas acres of post-treatment habitat for Alternatives 2 and 3 were estimated using a combination of remotely sensed data and stand exam data. Predicted post-treatment stand conditions were derived from modeled changes to existing conditions, which were based on stand exam data. Post-implementation conditions for portions of PACs not treated are based on remotely sensed data. Differences in these data sets are generally small, but occasionally cause small apparent errors of estimation in the number of post-implementation acres. For example, the Cascade PAC shows an increase of two acres of high capability nesting habitat after implementation of either alternative action, which likely represents a difference arising from estimation technique rather than a real increase in nesting habitat. Larger differences (greater than five acres) represent changes in the number of acres across CWHR size and density classes caused by treatments. Reductions in CWHR size and density classes following treatment are intuitive, but the source of increases in CWHR size classes may not be quite as apparent (i.e., how did the number of acres of a large size class increase following treatment?). As explained in the general description of direct and indirect effects of the proposed action, removal of understory and mid-story trees would generally reduce canopy cover and occasionally cause an increase in the predicted post-treatment CWHR size class as mean tree size increases following the removal of smaller size class trees. This type of change in predicted CWHR size class represents an increase in mean stem diameter, rather than physical growth of the stand.

Total acres of estimated goshawk nesting, perching, and foraging habitat within all wildlife analysis area PACs would not change by more than five percent following implementation of either alternative, a result of the prescriptions designed to retain suitable habitat within PACs. Post-treatment acres of high to moderate capability nesting habitats are predicted to be greater than existing conditions in both alternatives. Differences in data sets, as described above, may account for a small portion of the increase in suitable nesting acres. The remainder of the increase in suitable nesting acres reflects how prevalent encroaching small diameter understory is within the PACs, due to long-standing avoidance of treatments within PACs in the Lake Tahoe basin.

Perching and foraging habitats would decrease in Alternative 2 but increase by one percent in Alternative 3. The reason for the decrease in acres of suitable perching and foraging habitats for Alternative 2 is that treatments would remove both understory and mid-story trees, and mid-story trees comprise the medium CWHR size and density classes that are included in modeling suitable perching and foraging habitats. Alternative 3 would reduce the acres of treatments in PACs and would add more acres to existing PACs relative to the number of acres mechanically treated than Alternative 2. A portion of the one percent increase in the estimated number of perching and foraging acres in comparison to the existing condition in Alternative 3 may be due to differences in data sets used to estimate post-implementation conditions. Alternative 3 also retains more total acres of suitable habitats within PACs than Alternative 2.

Table 3-86. Acres of high and moderate capability habitat within current and remapped northern goshawk PACs in the analysis area by alternative (figures shown for alternatives are post-implementation)

PAC	Territory	PAC acres			Habitat Capability	Nesting			Perching			Foraging		
		Exist-ing	Alt 2	Alt 3		Exist-ing	Alt 2	Alt 3	Exist-ing	Alt 2	Alt 3	Exist-ing	Alt 2	Alt 3
Cascade	Spring Creek	200	200	200	High	139	141	141	154	185	187	154	185	187
					Moderate	0	0	0	39	11	13	39	11	13
					Total	139	141	141	193	196	200	193	196	200
Spring Creek	Spring Creek	200	200	200	High	192	192	192	192	192	192	192	192	192
					Moderate	0	0	0	0	0	0	0	0	0
					Total	192	192	192	192	192	192	192	192	192
Floating Island	Spring Creek	200	200	200	High	178	178	178	178	178	178	178	178	178
					Moderate	0	0	0	0	0	0	0	0	0
					Total	178	178	178	178	178	178	178	178	178
Tahoe Mountain	Tahoe Mountain	205	406	334	High	188	343	271	196	406	333	196	406	333
					Moderate	0	0	0	6	0	2	6	0	2
					Total	188	343	271	202	406	334	202	406	334
Seneca Pond	Angora 1	238	261	261	High	52	121	162	186	240	219	186	240	219
					Moderate	0	0	0	25	10	25	25	12	25
					Total	52	121	162	211	250	244	211	252	244
Big Meadow	Big Meadow	203	203	203	High	188	188	188	197	197	197	197	197	197
					Moderate	0	0	0	4	4	4	4	4	4
					Total	188	188	188	201	201	201	201	201	201
Round Lake	None	220	220	220	High	21	21	21	157	157	157	157	157	157
					Moderate	30	30	30	38	38	38	60	60	60
					Total	51	51	51	195	195	195	217	217	217
Upper Saxon Creek	Saxon Creek	204	204	204	High	44	44	44	68	68	68	68	68	68
					Moderate	118	118	118	128	128	128	136	136	136
					Total	162	162	162	196	196	196	204	204	204
Middle Saxon Creek	Saxon Creek	200	200	200	High	200	200	200	200	200	200	200	200	200
					Moderate	0	0	0	0	0	0	0	0	0
					Total	200	200	200	200	200	200	200	200	200
Lower	Saxon Creek	201	201	201	High	160	195	192	182	197	201	182	197	201

PAC	Territory	PAC acres			Habitat Capability	Nesting			Perching			Foraging		
		Existing	Alt 2	Alt 3		Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3
Saxon Creek					Moderate	0	0	0	19	4	0	19	4	0
					Total	160	195	192	201	201	201	201	201	201
Hellhole	Hellhole	203	286	271	High	193	286	271	193	286	271	193	286	271
					Moderate	0	0	0	9	0	0	9	0	0
					Total	193	286	271	202	286	271	202	286	271
Lower Trout Creek A	Cold Creek	230	230	230	High	93	222	115	169	222	116	169	222	116
					Moderate	0	0	0	60	3	110	60	5	113
					Total	93	222	115	229	225	226	229	227	229
Lower Trout Creek B	Cold Creek	203	203	203	High	179	192	179	179	192	179	179	192	179
					Moderate	0	0	0	23	10	23	23	10	23
					Total	179	192	179	202	202	202	202	202	202
Upper Cold Creek	Upper Cold Creek	204	204	204	High	95	95	95	158	158	158	158	158	158
					Moderate	0	0	0	44	44	44	44	44	44
					Total	95	95	95	202	202	202	202	202	202
High Meadows	High Meadows	218	218	218	High	1	1	1	27	27	27	27	27	27
					Moderate	92	92	92	120	120	120	171	171	171
					Total	93	93	93	147	147	147	198	198	198
Totals		3,129	3,436	3,349	Totals	2,163 (69%)	2,559 (74%)	2,490 (74%)	2,951 (94%)	3,177 (92%)	3,189 (95%)	3,032 (97%)	3,262 (95%)	3,273 (98%)

Canopy cover was also used to analyze effects of the proposed action and alternatives on goshawks and their habitat. Estimated canopy cover (i.e., number of acres with ≥60 percent tree canopy cover and mean tree canopy cover) for northern goshawk PACs in the South Shore wildlife analysis area are shown in Table 3-87 below, by alternative after implementation. Estimates of canopy cover were derived similarly to the estimates of CWHR high and moderate capability habitat above, using the same data sets. Canopy cover would be expected to decline following implementation of Alternatives 2 or 3. However, the source of the decline in canopy cover is important to the predicted suitability of treated stands for northern goshawk. A reduction in canopy cover due to the removal of small understory trees may improve habitat suitability, since goshawks prefer a more open understory.

Estimates of post-treatment CWHR high and moderate capability habitat are a useful cross-reference in determining whether reductions in canopy are likely to be beneficial or detrimental. For example, in Alternative 2 the Seneca Pond PAC canopy closure ≥60 percent would decline from 136 acres to 92 acres, and mean canopy would decline from 55 percent to 49 percent, while CWHR nesting, perching, and foraging habitat would increase from 52 acres to 121 acres, 211 acres to 250 acres, and 211 acres to 252 acres, respectively. Comparison of reductions in canopy and gains in nesting habitat suggest that the reductions in canopy cover are due to the removal of small or medium-sized trees, and, by comparing gains in nesting habitat to gains in perching and foraging habitat, that the changes in canopy are due mostly to the removal of small trees rather than medium-sized trees. In summary, canopy reductions that may first appear detrimental to forest structure within the Seneca Pond PAC are, upon careful review, predicted to improve habitat suitability for this species immediately after treatment and as the treated stands mature.

The slight increase (4 acre gain in acres with ≥60 percent canopy cover and 4 to 8 percent increase in mean canopy cover) in canopy cover for the Lower Trout Creek A PAC is likely an artifact of the methods and data used to estimate canopy cover (as described in CWHR size and density classes above).

Alternative 3 would generally retain more acres with ≥60 percent canopy cover and greater mean canopy cover than Alternative 2 as fewer PAC acres would be treated in Alternative 3. However, in the Seneca Pond, Lower Saxon Creek, and Lower Trout Creek A PACs (which would be treated in either alternative), reductions in canopy cover are greater in Alternative 3 than in Alternative 2 because treatment types would change from mechanical to hand thinning, necessitating revised treatment prescriptions (due to the differences in diameter limits for types of treatment). Hand thinning following the revised treatment prescriptions would increase the number of trees in small to medium-sized size classes removed to reach project goals for forest health and predicted fire behavior.

Table 3-87. Estimated canopy cover (acreage with ≥60% tree canopy cover and mean tree canopy cover) for northern goshawk PACs in the wildlife analysis area by alternative (figures shown for alternatives are post-implementation)

PAC	Territory	PAC Acres			Acres ≥ 60% Canopy Cover			Mean Canopy Cover		
		Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3
Cascade	Spring Creek	200	200	200	102	0	2	53	46	46
Spring Creek	Spring Creek	200	200	200	146	81	81	59	57	57
Floating Island	Spring Creek	200	200	200	47	47	47	55	55	55
Tahoe Mountain	Tahoe Mountain	205	406	334	51	45	45	53	49	53
Seneca Pond	Angora 1	238	261	261	136	92	91	55	49	47
Big Meadow	Big Meadow	203	203	203	6	6	6	51	51	51
Round Lake	None	220	220	220	12	12	12	41	41	41
Upper Saxon Creek	Saxon Creek	204	204	204	50	50	50	52	52	52
Middle Saxon Creek	Saxon Creek	200	200	200	67	51	67	60	58	60
Lower Saxon Creek	Saxon Creek	201	201	201	173	23	12	61	48	46
Hellhole	Hellhole	203	286	271	157	99	149	64	58	62
Lower Trout Creek A	Cold Creek	230	230	230	0	4	4	43	51	47
Lower Trout Creek B	Cold Creek	203	203	203	161	77	161	59	56	59
Upper Cold Creek	Upper Cold Creek	204	204	204	27	27	27	51	51	51
High Meadows	High Meadows	218	218	218	9	9	9	48	48	48
Total		3,129	3,436	3,349	1,144	623	763			
				Mean	76	42	51	54	51	52

A summary of direct and indirect effects of the proposed action and alternatives to northern goshawk PACs within the wildlife analysis area is presented in Table 3-88. Recommendations from the northern goshawk nesting territory assessment are included for comparison to the proposed and alternative actions. The nesting territory assessment (surveys completed in 2004 and 2005; assessment completed in 2007) was intended to provide supplemental information to LTBMU managers in planning restoration of northern goshawk territories, for purposes (i.e., restoration of wildlife habitat through vegetation management and road/trail management) different than the primary purpose of the proposed action (i.e., reduction of fuels and healthy forest restoration through vegetation management). Nevertheless, a comparison between the recommendations of the territory assessment and the South Shore project alternatives is useful in determining whether the current project would be complimentary to future goshawk nesting territory restoration projects (none currently planned).

The nesting territory assessment recommended vegetation treatments within goshawk habitats, including PACs, which move existing conditions toward “pre-settlement” conditions. The assessment proposed that timber management in the Lake Tahoe basin would benefit goshawks in the long term, but that timber management posed a substantial threat to goshawk reproductive activity during implementation, further stating that the adoption of measures (i.e., project design features) protecting goshawk reproductive activities and good communication between wildlife and vegetation managers could minimize risks incurred during implementation to realize those long term benefits – accurately describing protective measures and communication currently in place and that would occur as part of Alternatives 2 or 3 of the South Shore project. The assessment suggested that “structural differences between the forests of the frequently and infrequently occupied territories may have played a role in the avoidance or abandonment of some of the territories” and that “agencies should maintain large trees and dense canopies with open understories within territories.” The assessment elaborates how “goshawk habitat may be improved through silvicultural activities that reduce the densities of shrubs, saplings, and small poles, while maintaining or enhancing the canopy of large trees (Crocker-Bedford 1990). Graham et al. (1999) recommended increasing the numbers and distribution of large trees in the landscape by cleaning, thinning, and weeding using mechanical means or fire. Clearing the forest floor of small trees and lower vegetation should allow for easy hunting access (Graham et al. 1999).” CWHR size and density classes were used in the assessment to describe forest vegetation: meaning that “small” trees are those 11 to 24 inches dbh and younger trees are interpreted as pole (6 to 11 inches dbh), sapling (1 to 6 inches dbh), and seedling (less than 1 inch dbh) size classes. Occupancy indices were intended to identify relative probability of territory occupancy, reproduction, and fledging, and level of risk associated with entering a territory to conduct restorative activities (i.e., higher level of risk associated with more frequently occupied territories compared to moderately or infrequently-occupied territories).

The progression of treatments (i.e., during which phases of implementation treatments would occur in a PAC) are also included in the summary of direct and indirect effects of Alternatives 2 and 3 to northern goshawk PACs in the wildlife analysis area (Table 3-88). As stated in the description of the action alternatives, where treatment stands are located in close proximity to one another, vegetation treatments within those stands would be separated in time where feasible, to provide refuge for wildlife during implementation by avoiding simultaneous treatment of all PAC acres within a goshawk territory. Scheduling of treatments to minimize the level of localized effects in any given year would also manage potential impacts to other resources, such as effects to watersheds from sediment or nutrient transport processes..

Table 3-88. Summary of direct and indirect effects of the action alternatives to northern goshawks and their habitat within wildlife analysis area PACs

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
Cascade	Spring Creek	High risk of direct effects to individuals in this recently and frequently occupied PAC. Low risk of direct effect to reproduction as nesting not detected since 1984. 100% of existing PAC would be treated. PAC to be treated in all four phases of implementation. CWHR habitats nearly unchanged after treatment. Canopy cover reduced mainly by removal of small and medium trees. Assessment recommended removal of dense stands of younger trees and fall burning.	Same as Alternative 2 except that 89 acres of mechanical thinning would be switched to hand thinning and 5 acres would be eliminated from treatment (98% of PAC would be treated), reducing risk of direct and indirect effects to individuals.
Spring Creek	Spring Creek	High risk of direct effects to individuals in this recently and frequently occupied PAC. Moderate risk to reproduction (nest stand is adjacent to treatments). 35% of existing PAC to be treated (2^{nd} and 3^{rd} phases). CWHR habitats unchanged. Canopy cover reduced from ≥60 percent to ~53% in treated areas. Assessment recommended removal of dense stands of younger trees and fall burning.	Same as Alternative 2 except that 20 acres of mechanical thinning would be switched to hand thinning, reducing risk of direct and indirect effects to individuals.
Floating Island	Spring Creek	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Tahoe Mountain	Tahoe Mountain	High risk of direct effects to individuals in this recently but infrequently occupied PAC. Moderate risk to reproduction (last nested in 2003). 100% of existing PAC to be treated (2^{nd}, 3^{rd}, and 4^{th} phases). Proportion of nesting habitat reduced from 92% to 84%, but acres of nesting habitat increased from 188 acres to 343 acres. Proportion of perching and foraging habitats increased from 99% to 100% and increased from 202 acres to 406 acres. Canopy cover reduced from 53 percent to 49 percent. Assessment recommended thinning during the fall.	Same as Alternative 2 except that 72 acres of mechanical thinning would be switched to hand thinning, reducing risk of direct and indirect effects to individuals. Proportion of nesting habitat reduced from 92% to 81%, but acres of nesting habitat increased from 188 acres to 271 acres. Proportion of perching and foraging habitats increased from 99% to 100% and increased from 202 acres to 334 acres. Existing mean canopy cover retained.
Seneca Pond	Angora 1	Low risk of direct effects to individuals in this unoccupied and infrequently occupied PAC. Low risk to reproduction (no nests known). 92% of existing PAC to be treated (1^{st}, 2^{nd}, and 4^{th} phases). Proportion of nesting habitat increased from 22% to 46% and acres of nesting habitat increased from 52 acres to 121 acres. Proportion of perching and foraging habitats increased from 89% to 96% and increased from 211 acres to ~250 acres. Canopy cover reduced mainly by removal of small trees. Assessment did not address this	Same as Alternative 2 except that 66 acres of mechanical thinning would be switched to hand thinning and 33 acres would be eliminated from treatment (78% of existing PAC to be treated), reducing risk of direct and indirect effects to individuals. Proportion of nesting habitat increased from 22% to 62% and acres of nesting habitat increased from 52 acres to 162 acres. Proportion of perching and foraging habitats increased from 89% to 93% and increased from 211 acres to

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
		PAC, which was remapped after the Angora Fire.	244 acres.
Big Meadow	Big Meadow	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Round Lake	None	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Upper Saxon Creek	Saxon Creek	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Middle Saxon Creek	Saxon Creek	Moderate risk of direct effects to individuals in this recently and frequently occupied PAC. Moderate risk to reproduction (nest stand is ~500 meters from treatments). Only 7% of existing PAC to be treated (1^{st} and 4^{th} phases). CWHR habitats unchanged. Canopy cover reduced from ≥60 percent to 55% in treated areas. Assessment recommended removal of dense stands of younger trees.	Not treated: no direct, indirect, or cumulative effects would occur.
Lower Saxon Creek	Saxon Creek	High risk of direct effects to individuals in this recently and frequently occupied PAC. Low risk of direct effect to reproduction as nesting not detected since 1993. 97% of existing PAC to be treated (1^{st}, 3^{rd}, and 4^{th} phases). Nesting habitat increased from 160 to 195 acres. Mean canopy cover reduced from 61% to 48% mainly by removal of very dense stands of smaller diameter trees. Assessment recommended removal of dense stands of younger trees.	Same as Alternative 2 except that 12 acres of mechanical thinning would be switched to hand thinning and 5 acres would be added to treatments, netting an indistinguishable change in risk of direct and indirect effects to individuals. 99% of the existing PAC would be treated. Nesting habitat increased from 160 acres to 192 acres. Mean canopy cover reduced from 61% to 46% mainly by removal of very dense stands of smaller diameter trees.
Hellhole	Hellhole	High risk of direct effects to individuals in this recently and frequently occupied PAC. Moderate risk of direct effect to reproduction as nesting not detected since 2003. 43% of exiting PAC to be treated (1^{st}, 3^{rd}, and 4^{th} phases). Proportion of nesting habitat increased from 95% to 100% and acres of nesting habitat increased from 193 acres to 286 acres. Proportion of perching and foraging habitats unchanged at ~100%, but increased from 202 acres to 286 acres. Mean canopy cover reduced from 64% to 58% mainly by removal of small and medium trees. Assessment recommended maintaining current conditions.	Same as Alternative 2 except that 15 acres of mechanical thinning and 41 acres of hand thinning would be eliminated from treatment (33% of existing PAC to be treated), reducing risk of direct and indirect effects to individuals. Proportion of nesting habitat increased from 95% to 100% and acres of nesting habitat increased from 193 acres to 271 acres. Proportion of perching and foraging habitats unchanged at ~100%, but increased from 202 acres to 271 acres. Mean canopy cover reduced from 64% to 62% mainly by removal of small trees.
Lower Trout Creek	Cold Creek	Low risk of direct effects to individuals in this unoccupied and infrequently occupied PAC. Low risk of direct effect to	Same as Alternative 2 except that 160 acres of mechanical thinning would be eliminated from treatments (20% of existing

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
A		reproduction as nesting not detected since 1982. 89% of existing PAC to be treated during all phases. Nesting habitat increased from 93 to 222 acres. Canopy cover would be retained. Assessment recommended removal of dense stands of younger trees.	PAC would be treated during the 2nd and 4th phases), reducing risk of direct and indirect effects to individuals. Nesting habitat increased from 93 acres to 115 acres. Canopy cover would be retained.
Lower Trout Creek B	Cold Creek	Moderate risk of direct effects to individuals in this recently occupied, but infrequently occupied PAC. Moderate risk of direct effect to reproduction as nesting not detected since 2003. 43% of existing PAC to be treated during the 3rd and 4th phases. Nesting habitat increased from 179 to 192 acres. Mean canopy cover would be reduced from 59% to 56%. Assessment recommended removal of dense stands of younger trees.	Not treated: no direct, indirect, or cumulative effects would occur.
Upper Cold Creek	Upper Cold Creek	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
High Meadows	High Meadows	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.

Northern Goshawk Cumulative Effects

Alternative 1

No direct or indirect effects to northern goshawks or their habitat are expected; therefore no cumulative effects are expected.

Alternative 2

Nine of 15 PACs in six of the nine territories within the wildlife analysis area would be treated by the proposed action. The anticipated effects within each territory are generally characterized as short term disturbance trending toward long term benefit for the species and its habitat. The combined effect of the proposed action to goshawks and their habitat within these territories may be similarly characterized: short term disturbance to the goshawk population and habitat followed by long term benefit. The cumulative effect of the proposed action, when combined with past, present, and reasonably foreseeable future actions is to adversely affect individual goshawks and a portion of the suitable habitat present in the wildlife analysis area during and immediately following implementation, followed by benefits to goshawks and their habitat in the wildlife analysis area as stands mature during the 15-year period following implementation. The PACs that would be treated in Alternative 2, but not in Alternative 3, would likely benefit from treatment more than 15-years after implementation. Within the entire Lake Tahoe Basin, nine of the 32 PACS in six of the 26 (23%) territories and less than one percent of goshawk territories in the Sierra Nevada bioregion would be affected.

Alternative 3

Seven of 15 PACs in six of the nine territories within the wildlife analysis area would be treated by Alternative 3. Less effect to high quality territories would occur because the Middle Saxon Creek and Lower Trout Creek B PACs would not be treated. Survival and reproduction of goshawks within the wildlife analysis area would likely be increased relative to Alternative 2 during and immediately following implementation. The effects of Alternative 3 are expected to be more beneficial than those described above for Alternative 2. Within the entire Lake Tahoe Basin, the number of territories affected would remain the same as Alternative 2, however the number of PACs affected would be reduced to seven of the 32 PACs; and less than one percent of goshawk territories in the Sierra Nevada would be affected.

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the Northern Goshawk.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore project DEIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the Northern Goshawk. Rationale:

- Effects to goshawks are expected to transition from adverse disturbance-type effects during implementation toward beneficial habitat maturation-type effects over the 15-year period following implementation
- Initial reductions in suitable goshawk habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories
- Project implementation, in the context of the wildlife analysis area, is expected to benefit goshawks and their habitat in the long term

California Spotted Owl

The California spotted owl (*Strix occidentalis occidentalis*) is a Forest Service sensitive (S) and management indicator species (MIS) and a Tahoe Regional Planning Agency special interest species (SIS) on the Lake Tahoe Basin Management Unit. Please refer to the management indicator species report and Tahoe Regional Planning Agency impact analysis for this project for further discussion of this species in regards to its MIS and SIS status. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

California Spotted Owl Existing Conditions

The range of the California spotted owl (*Strix occidentalis occidentalis*) is divided into two major physiographic provinces, the Sierra Nevada Province and the Southern California Province, with Tehachapi Pass as the dividing line (Verner et al. 1992). The Sierra Nevada Province is comprised of the southern Cascade and Sierra Nevada ranges, while the Southern California Province is comprised of all the mountain ranges of Southern California and the Central Coast ranges at least as far north as Monterey County (Ibid). The distribution of spotted owls in the Sierra Nevada Province is characterized as continuous and of relatively uniform density (Ibid). The range of the California spotted owl was revised in 2005 based on mitochondrial deoxyribonucleic acid (mtDNA) haplotypes as follows: west slope (locally on east slope) of Sierra Nevada in California from Shasta (Pit River) and Lassen Counties south to Kern County, and mountains of central, coastal, southern, and transverse ranges of California from Monterey (south side of Carmel Valley) and Kern Counties south through San Diego County to Cuyamaca Mountains in California, and Sierra San Pedro Martir in Baja California Norte, Mexico (Gutierrez and Barrowclough 2005). The LTBMU is located on the edge of the range for this species; spotted owl nesting has not been recorded within the State of Nevada.

Concerns for the integrity of the spotted owl's range in California and Nevada and led to the identification of areas of concern (AOCs) in 1992 (Verner et al. 1992). Five conditions gave rise to these AOCs: 1) bottlenecks in the distribution of habitat or owl populations; 2) gaps in the known distribution of owls; 3) locally isolated populations; 4) highly fragmented habitat; and 5) areas of low crude density of spotted owls (Ibid). AOCs were mapped for California and Nevada, showing locations where "gap areas" between populations existed and where concerns for existing populations (e.g., due to low population density, relatively fragmented habitat or extensive loss of habitat from recent wildfires) were identified (Ibid).

AOC population or area gaps have not been identified to date on the LTBMU. The nearest identified AOC gap area to the LTBMU is a natural bottleneck between the ranges of northern and California spotted owls in eastern Shasta County. The nearest AOC populations to the LTBMU are located on the northeastern Tahoe and northern Eldorado National Forests, due largely to checker-board land ownerships, prevalence of granite outcrops and red fir forests, and low or unknown owl densities. Gutierrez and Barrowclough's (2005) refinements to the range of the spotted owl do not appear to have substantially affected AOCs located closest to the LTBMU.

Across the range of this species, a broad array of habitat types such as western hemlock, mixed evergreen, mixed conifer, Douglas fir, pine-oak, ponderosa pine, western incense cedar, redwood, Douglas fir/hardwood, and conifer/hardwood are used (Guiterrez et al. 1995). In the Sierra Nevada Province, spotted owls occur in conifer, mixed conifer/hardwood, and hardwood forests (Verner et al. 1992). More specifically, spotted owls use the following five vegetation types in the Sierra Nevada: foothill riparian hardwood, ponderosa pine/hardwood, mixed-conifer forest, red fir forest, and east side pine forest (USDA FS 2001). Mixed-conifer forest is used most frequently by this species in the Sierra Nevada: approximately 80 percent of known sites are found in mixed-conifer forest, 10 percent in red fir forest, seven percent in ponderosa pine/hardwood forest, and the remaining three percent in foothill riparian/hardwood forest and eastside pine (Ibid). Regardless of forest type, spotted owls select stands that have multiple age classes, complex structure, a high percentage of large trees, and high canopy closure (Bias and Guiterrez 1992, Guiterrez et al. 1992 *in* Verner et al. 1992).

Bond et al. (2004) described spotted owl nesting habitat as typically comprised of "forested stands with large trees, moderate-to-high tree densities, high canopy cover, and structural complexity". Structural complexity may be both horizontal and vertical. Habitats used for nesting typically have "greater than 70 percent total canopy cover (all canopy above 7 feet), except at very high elevations where canopy cover as low as 30 to 40 percent may occur as in some red fir stands of the Sierra Nevada" (Verner et al. 1992). Large snags and an accumulation of downed woody debris are typically present (Ibid). A study on the neighboring Eldorado National Forest found that nesting habitat, at the PAC scale, selected by spotted owls was correlated with interior (>328 feet or 100 meters from an edge) mid-seral forest having high canopy cover, and interior mature and old growth forest having at least 30 percent canopy cover (Chatfield 2005). In general, stands suitable for nesting and roosting have (1) two or more canopy layers, (2) dominant and codominant trees averaging at least 24 inches dbh, (3) at least 70 percent total canopy cover (including the hardwood component), (4) higher than average levels of very large, old trees, and (5) higher than average levels of snags and downed woody material (USDA FS 2001).

Surveys of 12 spotted owl nest stands in the Lake Tahoe basin, conducted by LTBMU biologists from 2002-2004, measured slope (mean=21 degrees), canopy closure (mean=77%), shrub cover (mean=9%), live-tree diameter (mean=18.4 inches), and aspect (north-facing=17%, east-facing=42%, south-facing=42%, and west-facing=0%) (unpubl. data).

Nesting behavior is initiated in February or early March when pairs begin roosting together and calling to each other more frequently at dusk before foraging or when returning to roost before dawn (Forsman 1976, Forsman et al. 1984). Egg-laying occurs in March or April (Ibid). The average incubation period is 30 ± 2 days, hatching peaks May 7-21 (Sierra Nevada), and fledging (i.e., defined as young leaving the nest) occurs generally when the nestlings are 34-36 days old (Forsman et al. 1984). The post-fledging dependency period extends through late summer; and dispersal from the natal site occurs in September or October (Gutierrez et al. 1985, Miller 1989). A spotted owl ecology study on the Lassen National Forest (study area 1200-2100 m) found that approximately 90 percent of juveniles fledged by July 8 (Blakesley et al. 2005b).

Investigations into the thermal ecology and ecological energy requirements of spotted owls (Weathers et al. 2001 and Blakesley et al. 2005b) found that this species' metabolic rate increases faster than predicted in response to thermal stress, and that spotted owls have exceptionally low energy requirements compared to birds of similar type and size. There is considerable debate (Verner et al. 1992) regarding whether spotted owls prefer or require the micro-habitats presumed to occur within old growth or late seral forested habitats for nesting or roosting based on species-specific thermal ecology and energy needs. Several previous studies of roosting habitat use indicate that northern spotted owls move vertically and horizontally within the canopy to exploit more favorable micro-climates (Barrows and Barrows 1978, Forsman 1980, Barrows 1981, Solis 1983, and Forsman et al. 1984). Yet, Verner et al. (1992) presented evidence that California spotted owls occupy and breed in habitats with high ambient summer temperatures and at least occasionally nest or roost in full sunlight when ambient temperatures exceed 100 degrees Fahrenheit; well above their average body temperature (Weathers et al. 2001).

Spotted owls forage in forested habitats characterized by multiple vegetative strata, large tree size classes, high tree basal areas and woody debris (Call et al. 1992). On the Tahoe National Forest habitat use is not random; spotted owls use areas with large trees and 40 to greater than 70 percent canopy closure more than would be expected by chance (Call et al. 1992). Chatfield

(2005) found that this species selected habitats, at the territory scale, on the Eldorado and Tahoe National Forests characterized as late seral forests with at least 30 percent canopy closure and mid-seral forests with 70 percent or greater canopy closure. In general, stands suitable for owl foraging have (1) at least two canopy layers, (2) dominant and co-dominant trees in the canopy averaging at least eleven inches in dbh, (3) at least 40 percent canopy cover in overstory trees (30 percent in red fir), and (4) higher than average numbers of snags and downed woody material (USDA FS 2001).

The diet of spotted owls varies geographically (Gutierrez et al. 1995). Spotted owls in the Sierra Nevada Province prey mainly on northern flying squirrels (*Glaucomys sabrinus*) whereas owls in the Southern California province prey almost exclusively on dusky-footed woodrats (*Neotoma fuscipes*) (Verner et al. 1992). On the Lassen National Forest, flying squirrels constituted 61 percent of the diet by mass (Blakesley et al. 2005a, 2005b). On the Eldorado National Forest the primary dietary component varies by elevation: flying squirrels in upper elevation (red fir) stands, ground squirrels and gophers in mid-elevation (sierran mixed conifer) stands, and woodrats in lower elevation (conifer/oak forest) stands (Eldorado National Forest spotted owl demography crew unpubl. data). Other prey species in the Sierra Nevada include “deer mice (*Peromyscus maniculatus*), voles (*Microtus* spp.), bats, amphibians, insects (which are consumed with the highest frequency but represent a much lower percentage of the diet by mass), ground and tree squirrels, chipmunks (*Tamias* spp.), and some species of birds” (summarized by Verner et al. 1992 and Gutierrez et al. 1995 *in* USDA FS 2000).

CWHR forest vegetation types and strata are the primary metrics used for the California spotted owl in this analysis. Snag and coarse woody debris abundance are incorporated in the project design features and addressed through pre-treatment surveys, treatment prescriptions, and implementation monitoring. Approximately 80.4 percent of the forested acres within known spotted owl nest stands in the Lake Tahoe Basin are sierran mixed conifer (SMC) 4M, 4D, and 5M, vegetation strata which CWHR does not describe as high or moderate capability nesting habitat. Why spotted owls consistently select these strata in SMC stands for nesting within the Lake Tahoe Basin is not clear. SMC 4M, 4D, and 5M stands may provide the most suitable nesting habitat, relative to the habitats currently available, for this species on this edge of its range (no spotted owl nests are known in Nevada). SMC 4M, 4D, and 5M stands may be sub-optimal for nesting as spotted owls do not appear to prefer these types of stands elsewhere. Regardless, as evidenced by the recurrently successful reproduction occurring in these stands locally, it is clear that SMC 4M, 4D, and 5M stands provide at least moderate capability nesting habitat within the Lake Tahoe Basin. Therefore, for the purposes of this analysis, SMC 4M, 4D, and 5M stands are considered moderate capability spotted owl nesting habitat (in addition to eastside pine 5D and lodgepole pine 5D stands as identified by CWHR).

High and moderate capability rooting and foraging habitat was determined using CWHR types within the wildlife analysis area. The estimated acres of high and moderate capability nesting habitat, acres of high and moderate capability roosting habitat, and acres of high and moderate capability foraging habitat that currently exist for California spotted owl within the wildlife analysis area are given in Table 3-89.

Table 3-89. Existing acres of high and moderate capability California spotted owl habitat within the project wildlife analysis area

Habitat Capability	Nesting Habitat	Roosting Habitat	Foraging Habitat
High	53	697	697
Moderate	9,507	12,866	13,243
Total	9,560	13,563	13,940

Spotted owls are territorial, generally non-migratory, and exhibit high site fidelity (Blakesley et al 2005b, 2006). Zimmerman et al. (2003) investigated whether this territorial species follows an ideal despotic distribution (IDD) and found a positive correlation between territory occupancy and "potential fitness" as estimated from survival and reproduction; generally supporting an IDD conceptual theory, in which territorial behavior causes the best territories to be occupied first, and low quality territories to be occupied only when high quality territories are already occupied. Perceptual limitations, prey dynamics, and large territory sizes were identified as potential factors affecting the ability of individual owls to assess habitat quality accurately. Dispersal processes, high survival rates, and long life spans were suggested as other key factors that may prevent some individuals from selecting the highest quality sites as predicted (Ibid).

The distribution of spotted owls in the Lake Tahoe basin is presumed to be approximated by an IDD and the population to be generally non-migratory, though surveys for spotted owls, including banded individuals, have not been conducted outside the breeding season on the Forest. A demographic study completed on the Lassen National Forest found breeding dispersal in only seven percent of inter-annual observations of banded individuals, demonstrating site fidelity behavior (Blakesley et al. 2005b). Similar demographic work, though substantially more limited in scope, completed on the LTBMU in cooperation with the Tahoe and Eldorado National Forests found that spotted owls on the LTBMU also appear to have site fidelity (unpubl. data). The benefits of site fidelity are presumed to occur in recurrently occupied territories, and include a potential increase in foraging efficiency and ability to avoid predation. An analysis using data from a nine-year demography study on the Sierra National Forest and Sequoia-Kings Canyon National Park found that spotted owl nests used for ≥3 years produced twice as many young per owl pair compared to nests used for only one year, suggesting that reproduction may be influenced by more than territory quality, including nest predation or breeding history (North et al. 2000).

Spotted owl habitat use and life history requirements may be discussed at spatial scales varying from the nest stand (smallest) to the non-breeding home range (largest).

The nest stand (approximately 100 acres) includes one or more forest vegetative stands, the nest tree, and possibly several roost sites. Nest stands may be occupied by breeding spotted owls from February until October, and are the focus of all movements and activities associated with nesting. Spotted owls may have more than one nest stand within their home range, and nest stands may be used intermittently for many years. Nest stands appear to be correlated with high canopy cover (≥70%) mid seral forest, and mature and old growth forest with at least 30% canopy cover (Chatfield 2005).

The protected activity center (PAC) includes 300 acres of the highest quality nesting habitat available, and the most recent nest site or activity center within a spotted owl breeding territory as described in management direction for the forest (USDA FS 2004b). A PAC size of 300 acres corresponds with the following two criteria reported by Verner et al. (1992) in the California Spotted Owl report: 1) the size of the nest stand and adjacent suitable nesting stands; and 2) the area encompassing approximately 50% of radio-telemetry locations within spotted owl territories on the Sierra National Forest (USDA FS 2001). There are currently 21 California spotted owl protected activity centers on the LTBMU.

A home range core area (HRCA) includes its associated PAC, is 1,000 acres is size, and is composed of the best available contiguous habitat. The core area corresponds with 20% of a breeding pair home range plus one standard error. While home ranges vary substantially across the range of this subspecies, an HRCA is specified as 1,000 acres for the LTBMU. Radio telemetry studies have not been undertaken for California spotted owls in the LTBMU, so accurate home range information is currently unavailable.

Surveys for spotted owls were conducted in the wildlife analysis area following the USFS, Region 5 protocol for surveying for spotted owls in proposed management activity centers and habitat conservation areas (USDA FS 1991, revised 1993) in 2006 and 2007. An estimated total 20,170 acres (approximately 13,764 acres for the South Shore project and an additional 6,406 acres for other projects) were surveyed for spotted owls within the wildlife analysis area in 2006 and 2007. In addition, a long-term spotted owl survey history (20+ years) exists in the wildlife analysis area. The results of the project-specific, relevant concurrent and historic surveys are considered in this analysis.

The LTBMU coordinates with the CDFG biogeographic data branch, biogeographic information and observation system (BIOS) project in recording spotted owl territory discovery and activity. These records are stored in the California spotted owl “Master Owl” database. CDFG and the LTBMU jointly recognize eight spotted owl territories within the wildlife analysis area (Spring Creek, Tahoe Mountain, Echo Lake, Hawley Grade, Round Lake, Saxon Creek, Hellhole, and Cold Creek; LTBMU territory names given). It is important to note that spotted owl PACs and territories do not always correlate on a one-to-one basis. The territories currently recognized are based on retrospective examination of approximately 27 years (1981-2007) of surveys whereas spotted owl PACs are delineated prospectively as nesting and/or occupancy are discovered. The prospective delineation of PACs is a conservative management approach. The Forest also follows a conservative approach in eliminating spotted owl PACs, which in some cases results in multiple PACs within a single territory.

The likely contribution of each PAC to spotted owl productivity is estimated using the method described in the Forest Plan, as amended by the Framework (2004). Rankings of 1 (lowest contribution to productivity) to 5 (highest contribution to productivity) are determined as follows: 1) PACs presently unoccupied and historically occupied by territorial singles only; 2) PACs presently unoccupied and historically occupied by pairs; 3) PACs presently occupied by territorial singles; 4) PACs presently occupied by pairs; and 5) PACs currently or historically reproductive.

Nine California spotted owl PACs and HRCAs are currently established within the wildlife analysis area. The Tahoe Mountain spotted owl PAC and HRCA were affected by the Angora Fire and were re-mapped within the wildlife analysis area. All LTBMU spotted owl PACs and HRCAs were remapped in 2008 to incorporate the most up-to-date detection, nest location, and land boundary information available. California spotted owl PACs are delineated to include the best available 300 acres of nesting habitat as described in management direction for the forest (USDA FS 2001, USDA FS 2004). The amount of high and moderate capability nesting, roosting, and foraging habitat within each spotted owl PAC varies according to what is available, given existing conditions, on the forest. Table 3-90 summarizes existing PAC acreage and the estimated number of acres of high and moderate capability nesting, roosting, and foraging habitat for each spotted owl PAC within the wildlife analysis area.

Table 3-90. Existing acres of high and moderate capability habitat within California spotted owl PACs in the wildlife analysis area

Protected Activity Center	Master Owl Territory	PAC Acres	Habitat Capability	Nesting Habitat	Roosting Habitat	Foraging Habitat
Spring Creek	Tallac Creek	300	High	3	16	16
			Moderate	256	243	243
			Total	259	259	259
Tahoe Mountain	Tahoe Mountain	300	High	0	7	7
			Moderate	224	218	218
			Total	224	225	225
Echo Lake	Lower Echo	300	High	0	0	0
			Moderate	5	251	251
			Total	5	251	251
Hawley Grade	Benwood Meadow	300	High	0	0	0
			Moderate	147	147	147
			Total	147	147	147
Round Lake	Round Lake	300	High	0	0	0
			Moderate	6	105	110
			Total	6	105	110
Upper Saxon Creek	Saxon Creek	300	High	0	2	2
			Moderate	26	204	204
			Total	26	206	206
Lower Saxon Creek	Saxon Creek	300	High	0	0	0
			Moderate	200	266	266
			Total	200	266	266
Hellhole	Trout Creek	300	High	0	7	7
			Moderate	42	35	35
			Total	42	42	42
Cold Creek	Cold Creek	300	High	0	0	0
			Moderate	191	191	191
			Total	191	191	191
Total		2,700	High and Moderate	1,100	1,692	1,697

California spotted owl HRCAs are delineated to include the best available 1,000 acres of habitat as described in management direction for the forest (USDA FS 2001, USDA FS 2004). The amount of high and moderate capability nesting, roosting, and foraging habitat within each spotted owl HRCA varies according to what is available, given existing conditions, on the forest. Table 3-91 summarizes existing HRCA acreage and the estimated number of acres of high and moderate capability nesting, roosting, and foraging habitat for each spotted owl HRCA within the wildlife analysis area.

Table 3-91. Existing acres of high and moderate capability habitat within California spotted owl HRCAs in the wildlife analysis area

Home Range Core Area	Master Owl Territory	HRCA Acres	Habitat Capability	Nesting Habitat	Roosting Habitat	Foraging Habitat
Spring Creek	Tallac Creek	1,000	High	7	26	26
			Moderate	515	492	492
			Total	522	518	518
Tahoe Mountain	Tahoe Mountain	1,000	High	0	13	13
			Moderate	372	359	384
			Total	372	372	397
Echo Lake	Lower Echo	1,000	High	0	6	6
			Moderate	22	786	786
			Total	22	792	792
Hawley Grade	Benwood Meadow	1,000	High	0	25	25
			Moderate	552	527	527
			Total	552	552	552
Round Lake	Round Lake	1,000	High	0	0	0
			Moderate	195	450	456
			Total	195	450	456
Upper Saxon Creek	Saxon Creek	1,000	High	0	28	28
			Moderate	44	402	402
			Total	44	430	430
Lower Saxon Creek	Saxon Creek	1,000	High	0	10	10
			Moderate	732	803	803
			Total	732	813	813
Hellhole	Trout Creek	1,000	High	0	15	15
			Moderate	382	384	384
			Total	382	399	399
Cold Creek	Cold Creek	1,000	High	0	1	1
			Moderate	391	394	460
			Total	391	395	460
Total		9,000	High and Moderate	3,212	4,721	4,817

In summary, Table 3-92 (below) provides a summary of the following information for each of the nine spotted owl PACs in the wildlife analysis area: 1) PAC (and HRCA) name; 2) associated Master Owl territory name; 3) nesting, fledging, and occupancy detected since 1981 (for years in which surveys were completed); 4) whether detections occurred in association with the PAC in the previous three breeding seasons (2005-2007); 5) contribution to owl productivity (as described above); and 6) whether a vegetation treatment is proposed within the PAC or HRCA under Alternatives 2 or 3. A summary of whether spotted owl activity was detected within the previous three years (USDA FS 2004, p.60) is presented in the table to highlight PACs with recent activity.

Table 3-92. Summary information for California spotted owl Protected Activity Centers within the wildlife analysis area.

Protected Activity Center	Master Owl Territory	Nesting, Fledging, and Occupancy Detected in PAC	Detection in PAC 2005-2007	Contribution to Productivity[a]	Treated in Alternative 2		Treated in Alternative 3	
					PAC	HRCA	PAC	HRCA
Spring Creek	Tallac Creek	Original nest in 2002 (used only in 2002); fledged one in 2002; detections in 2001-04 and 2006-07.	Yes	5	Yes	Yes	Yes	Yes
Tahoe Mountain	Tahoe Mountain	No known nest; no known fledglings; detections in 1993, 2000, and 2007.	Yes[b]	4[c]	Yes	Yes	Yes	Yes
Echo Lake	Lower Echo	No known nest; no known fledglings; detections in 2000 and 2001.	No	1	Yes	Yes	Yes	Yes
Hawley Grade	Benwood Meadow	Suspected nest identified in 2000, but tree fell in winter 2000-01; fledged two in 1999 and 2000; detections in 1999-2005.	Yes	5	Yes	Yes	Yes	Yes
Round Lake	Round Lake	No known nest; no known fledglings; detections in 1992, 1994, 1999, and 2000.	No	1	No	No	No	No
Upper Saxon Creek	Saxon Creek	No known nest; fledged two in 1999; detections in 1982 and 1999-2002.	No	5	No	No	No	No
Lower Saxon Creek	Saxon Creek	Original nest in 2002 (reused in 2004 and 2007), different nest in 2003; likely fledged one in 2003, two fledged in 2004 and 2007; detections in 1991-92, 1996-2005, and 2007.	Yes	5	No	Yes	No	Yes
Hellhole	Trout Creek	No known nest; no known fledglings; detections in 1998-2000 and 2002.	No	2	Yes	Yes	Yes	Yes
Cold Creek	Cold Creek	Original nest in 2002 (reused in 2003, 2004 and 2006); fledged one in 2002, fledged two in 2003 and 2004, fledged three in 2006; detections in 1999-2005 and 2007.	Yes	5	Yes	Yes	No	Yes

[a] Rankings of 1 (lowest contribution to productivity) to 5 (highest contribution to productivity) were determined following USDA FS (2004a) standard and guide #71 as follows: 1) PACs presently unoccupied and historically occupied by territorial singles only; 2) PACs presently unoccupied and historically occupied by pairs; 3) PACs presently occupied by territorial singles; 4) PACs presently occupied by pairs; and 5) PACs currently or historically reproductive.
[b] Detections associated with PAC as it existed before the Angora Fire given.
[c] Owl pair detected immediately after the Angora Fire adjacent to PAC (as remapped during the fall following the fire).

California Spotted Owl Direct and Indirect Effects

Alternative 1 – No Action

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Within PACs and HRCAs, understory and mid-story vegetation would continue to increase in density, reducing habitat suitability and increasing risk to forest health, and continuing moderate to very high risk of stand replacing fire. While there are consequences of inaction, the No Action alternative would not affect spotted owls or their habitats. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Spotted owls tend to be sensitive to disturbance and generally avoid urban areas and portions of the WUI that are most impacted by ongoing human disturbance. Exceptions exist, such as the nest stands located adjacent to the seasonally occupied Spring Creek and Hawley Grade Recreation Residence tracts, however, most spotted owl activity centers in the Lake Tahoe basin have been detected in relatively less-disturbed suitable habitat with the most suitable PACs occupied first, and least suitable habitats occupied only after the more suitable PACs have been taken.

Protection of spotted owls and their habitat within nest stands are addressed in the project design features with limited operating periods, identification of nest trees, and nesting habitat-specific treatment prescriptions, which are expected to reduce the risk of adverse effects for direct mortality of individuals or abandonment of the nest stand resulting from project implementation. Similarly, at the larger PAC spatial scale, project design features are expected to minimize potential adverse effects to spotted owls and their habitat during implementation. Design features of minimum canopy cover, snag retention, and coarse woody debris retention are expected to minimize potential adverse effects to spotted owl habitat within HRCAs.

California spotted owl habitat use is divided into three roughly concentric areas, with the nest and associated PAC as the center area of primary importance and the area most sensitive to disturbance, where LOPs are applied. Outside of the PAC is the larger home range core area (HRCA). LOPs are not applied at the HRCA, but spotted owl habitat prescriptions would be applied to retain greater stand density and CWD unless the HRCA overlaps an urban core area. The third area, the largest and outermost habitat area is the home range, where neither LOPs nor spotted owl habitat prescriptions would be applied. Direct disturbance is of most consequence at the nest site and within the PAC, decreases moving outward into the HRCA area, and is of least consequence in the much larger home range area. Direct effects are more likely to occur at the HRCA scale, because a larger area is affected by vegetation treatments, but potential effects would be smaller in magnitude, because HRCA areas are considered to be less important in meeting the life requirements of this highly mobile species. Similarly, effects are most likely to occur at the largest scale of the home range, where more acres would be treated, but treatment effects would be of the least consequence to the species.

Alternative 3 reduces the risk of adverse effects to spotted owls and their habitat to a greater degree than Alternative 2, as fewer nest stands, PACs, acres within HRCAs, and home ranges would be treated, and fewer acres would be mechanically thinned. Effects to spotted owls would be expected to transition from disturbance-type effects (e.g., flushing of an individual in response to the operation of equipment) during implementation toward habitat maturation effects from the growth of a stand toward desired conditions over time. An initial reduction of suitable spotted owl habitat would be followed by growth of treated stands along trajectories more beneficial than current trajectories. Long term trends in vegetation structure, composition, and distribution at the

PAC and HRCA scales following implementation of Alternatives 2 or 3 are expected to benefit spotted owls and their nesting habitat. Implementation of either action alternative is expected to directly and indirectly benefit spotted owls and their habitat in the long term.

The estimated number of acres of high and moderate capability spotted owl nesting, roosting, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-93. Total existing acres of these habitats within the wildlife analysis area are included for comparison. Alternatives 2 and 3 would reduce the amount of high and moderate capability spotted owl nesting habitat available in the wildlife analysis area by an estimated 17 percent and 14 percent, respectively. More moderate than high capability nesting habitat would be affected in both alternatives, though little high capability habitat was estimated to exist in the wildlife analysis area using remote sensing data. Note that the number of acres (53 acres) of high capability spotted owl nesting habitat estimated by remotely sensed vegetation mapping within the wildlife analysis area (Table 3-93) are underestimated and that implementation of Alternatives 2 or 3 would reduce high capability nesting habitat by 70 acres using stand exam data (slightly more than estimated to currently exist). Reasons for the discrepancy are related to differences in the data sets as described above (see goshawk). High capability spotted owl nesting habitat would remain in the wildlife analysis area following implementation of Alternatives 2 or 3. For either action alternative, there are high quality, late seral, closed canopy stands located outside both the WUI treatment stands and portions of the forest logged during the Comstock-era.

Project implementation would reduce total available roosting habitat within the analysis area by 12 percent in Alternative 2, or 10 percent in Alternative 3, while increasing high capability roosting habitat by 260 acres (2 percent) in either action alternative. Total available foraging habitat within the analysis area by would be affected similarly; a reduction of 10 percent in Alternative 2, or 9 percent in Alternative 3, while increasing high capability foraging habitat by 260 acres (2 percent) in either action alternative.

In either action alternative, the changes in habitat predicted would be distributed differentially within the WUI. Project design features are expected to minimize reduction of high or moderate capability habitat within spotted owl habitats at the nest stand, PAC, and HRCA scales. Potential benefits to spotted owl habitat are expected more often within nest stands and PACs, while potential detrimental effects to habitat are expected more often closer to urbanized areas outside nest stands and PACs. Since treatments would occur in the WUI and affected spotted owl territories are located both in the WUI and in large tracts of suitable habitat that would not be treated, spotted owl territories are generally expected to persist during implementation and over the long term. The planned scheduling of treatment phases would provide refuge areas of suitable habitat from potential direct effects during implementation.

A possible exception is the Tahoe Mountain spotted owl territory, which was directly affected by the 2007 Angora Fire by stand replacing fire in much of the territory. The remapped adjacent habitat would be treated in either action alternative. As elsewhere in PACs and HRCAs, long term benefits to habitat suitability from changes in stand structure are expected, but potential disturbance to individual spotted owls would be more likely to occur as owls in this territory have fewer areas of refuge from disturbance in upslope watersheds than other territories. Effects to habitat for this territory are also discussed below.

Fine scale habitat fragmentation would result from implementation of either action alternative due to reductions in stand area or interior area or changes in stand edge or insularity as described above for marten. Fine scale habitat fragmentation would occur during implementation as equipment and operations cause higher than background-level disturbance and make portions of the wildlife analysis area temporarily unsuitable. The effect of this type of fragmentation on individual spotted owls would be minimized by the rotation of treatment phases and because implementation would generally occur during the daytime when this species is least active.

Coarse scale habitat fragmentation would increase in either action alternative with a reduction in high and moderate capability habitats. However, the increase in coarse scale fragmentation is expected to be slight and focused on urban areas, which are of the lowest value to spotted owl reproduction, for the following reasons:

- Project design features would reduce potential effects to habitats within PACs,
- Multiple PACs exist for the Saxon Creek territory,
- The majority of treatments would occur in the WUI defense zone (around the urban core) and not affect surrounding suitable habitats located outside the WUI,
- Connectivity between large tracts of high capability habitats would be retained in either action alternative (e.g., lower and mid-elevation slopes of the Freel Peak massif and the Upper Truckee River watershed).

Habitat connectivity at the landscape scale is expected to be preserved at a level similar to, but slightly less than, the existing condition.

Table 3-93. Estimated acres of high and moderate capability California spotted owl habitat within the project area before and after implementation of Alternative 2 or 3, with comparison to the wildlife analysis area

	Habitat Capability	Nesting Habitat			Roosting Habitat			Foraging Habitat		
		Before	After	Change	Before	After	Change	Before	After	Change
Alternative 2	High	70	0	-70	284	544	+260	284	544	+260
	Moderate	4,688	3,145	-1,543	4,825	2,890	-1,935	5,876	4,250	-1,626
	Total	4,758	3,145	-1,613	5,109	3,434	-1,675	6,160	4,794	-1,366
Alternative 3	High	70	0	-70	273	533	+260	273	533	+260
	Moderate	4,506	3,220	-1,286	4,646	2,968	-1,678	5,709	4,168	-1,451
	Total	4,576	3,220	-1,356	4,919	3,501	-1,418	5,982	4,701	-1,281
Wildlife Analysis Area	High	53			697			697		
	Moderate	9,507			12,866			13,243		
	Total	9,560			13,563			13,940		

The numbers of acres of treatments within current spotted owl PACs in the wildlife analysis area are presented in Table 3-94, by treatment type and alternative. Alternative 2 would treat approximately 31 percent of the acres in wildlife analysis area PACs (21 percent mechanically and 10 percent by hand). Alternative 3 would avoid mechanical treatments in PACs where possible: treatments were converted to hand thinning or eliminated based on stand conditions and predicted fire behavior. Alternative 3 would reduce mechanical treatments in PACs by 278 acres, increase hand treatments by 39 acres, and reduce total treatments by 239 acres. Alternative 3 would treat approximately 23 percent of the acres in wildlife analysis area PACs (12 percent mechanically and 11 percent by hand).

Table 3-94. Acres of treatments within current California spotted owl PACs in the wildlife analysis area by treatment type and alternative

Protected Activity Center	PAC Acres	Mechanical		Hand		Total	
		Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Spring Creek	300	0	0	44	44	44	44
Tahoe Mountain	300	233	148	67	153	300	300
Echo Lake	300	25	25	33	33	58	58
Hawley Grade	300	9	9	79	18	88	27
Round Lake	300	0	0	0	0	0	0
Upper Saxon Creek	300	0	0	0	0	0	0
Lower Saxon Creek	300	0	0	0	0	0	0
Hellhole	300	214	127	41	55	254	182
Cold Creek	300	106	0	0	0	106	0
Total	2,700	587	309	264	303	850	611

Similarly, the numbers of acres of treatments within current spotted owl HRCAs in the wildlife analysis area are presented in Table 3-95, by treatment type and alternative. Alternative 2 would treat approximately 33 percent of the acres in wildlife analysis area HRCAs (22 percent mechanically and 11 percent by hand). Alternative 3 would reduce mechanical treatments in HRCAs by 813 acres, increase hand treatments by 373 acres, and reduce total treatments by 442 acres. Alternative 3 would treat approximately 28 percent of the acres in wildlife analysis area HRCAs (13 percent mechanically and 15 percent by hand).

Table 3-95. Acres of treatments within current California spotted owl HRCAs in the wildlife analysis area by treatment type and alternative

Home Range Core Area	HRCA Acres	Mechanical		Hand		Total	
		Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Spring Creek	1,000	420	214	122	324	542	536
Tahoe Mountain	1,000	677	437	247	466	924	903
Echo Lake	1,000	84	85	61	53	145	138
Hawley Grade	1,000	10	15	219	151	229	166
Round Lake	1,000	0	0	0	0	0	0
Upper Saxon Creek	1,000	0	0	0	0	0	0
Lower Saxon Creek	1,000	9	5	240	229	249	234
Hellhole	1,000	419	273	140	180	559	451
Cold Creek	1,000	353	131	0	0	353	131
Total	9,000	1,972	1,160	1,029	1,403	3,001	2,559

Following management direction from the 2004 Framework, acres would be added to PACs where mechanical treatments are proposed (Table 3-96). Added acres are comparable in quality to those that would be mechanically treated. Fewer acres would be added to PACs in Alternative 3 because fewer acres would be mechanically treated.

Table 3-96. Acres added to current California spotted owl PACs in the wildlife analysis area as mitigation for mechanical treatments within these land allocations by action alternative

Protected Activity Center	Current PAC Acres	Mechanical		Proposed Additional Acres		Total Proposed PAC Acreage	
		Alt 2	Alt 3	Alt 2	Alt 3	Alt 2	Alt 3
Spring Creek	300	0	0	0	0	300	300
Tahoe Mountain	300	233	148	233	148	533	448
Echo Lake	300	25	25	25	25	325	325
Hawley Grade	300	9	9	9	9	309	309
Round Lake	300	0	0	0	0	300	300
Upper Saxon Creek	300	0	0	0	0	300	300
Lower Saxon Creek	300	0	0	0	0	300	300
Hellhole	300	214	127	214	127	514	427
Cold Creek	300	106	0	106	0	406	300
Total	2,700	587	309	587	309	3,287	3,009

Spotted owl PACs were remapped for each alternative, including additional proposed PAC acreages. Acres of high and moderate capability nesting, perching, and foraging habitat within current and remapped PACs are shown below in Table 3-97, and for HRCAs in Table 3-98, by alternative (post-implementation). As was done for northern goshawk PACs, acres of habitat for existing spotted owl PACs and HRCAs were estimated using remotely sensed data whereas acres of post-treatment habitat for Alternatives 2 and 3 were estimated using a combination of remotely sensed data and stand exam data. Predicted post-treatment stand conditions were derived from modeled changes to existing conditions, which were based on stand exam data. Post-implementation conditions for portions of PACs and HRCAs not treated are based on remotely sensed data. Differences in these data sets are generally small, but occasionally cause small apparent errors of estimation in the number of post-implementation acres. Please see the discussion presented on this topic in the analysis for northern goshawk above.

Total acres of estimated spotted owl nesting, perching, and foraging habitat within all wildlife analysis area PACs would not change by more than seven percent following implementation of either alternative, a result of the design features to retain suitable habitat within PACs. Post-treatment acres of high to moderate capability nesting, roosting, and foraging habitats are predicted to be greater than existing conditions for both alternatives. Differences in data sets, as described above, may account for a small portion of the increase in suitable nesting acres. The remainder of the increase in suitable nesting acres reflects how prevalent encroaching small-diameter understory growth is within the PACs, likely due to long-standing avoidance of treatments within PACs in the Lake Tahoe basin. Alternative 2 would result in more suitable acres of high and moderate capability spotted owl habitats (predicted by CWHR modeling) than Alternative 3. Alternative 3 would also increase predicted acreages of suitable habitats compared to the existing condition, while reducing the number of acres mechanically treated within PACs in comparison to Alternative 2.

Table 3-97. Acres of high and moderate capability habitat within current and modified California spotted owl PACs in the wildlife analysis area by alternative (figures shown for alternatives are post-implementation)

PAC	Master Owl Territory	PAC acres			Habitat Capability	Nesting			Roosting			Foraging		
		Existing	Alt 2	Alt 3		Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3
Spring Creek	Tallac Creek	300	300	300	High	3	3	3	16	16	16	16	16	16
					Moderate	256	254	266	243	254	254	243	254	254
					Total	259	257	269	259	270	270	259	270	270
Tahoe Mountain	Tahoe Mountain	300	533	448	High	0	0	0	7	0	0	7	0	0
					Moderate	224	347	314	218	347	314	218	362	330
					Total	224	347	314	225	347	314	225	362	330
Echo Lake	Lower Echo	300	325	325	High	0	0	0	0	12	3	0	12	3
					Moderate	5	2	2	251	238	245	251	238	245
					Total	5	2	2	251	250	248	251	250	248
Hawley Grade	Benwood Meadow	300	309	309	High	0	0	0	0	0	0	0	0	0
					Moderate	147	183	158	147	183	158	147	183	158
					Total	147	183	158	147	183	158	147	183	158
Round Lake	Round Lake	300	300	300	High	0	0	0	0	0	0	0	0	0
					Moderate	6	6	6	105	105	105	110	110	110
					Total	6	6	6	105	105	105	110	110	110
Upper Saxon Creek	Saxon Creek	300	300	300	High	0	0	0	2	2	2	2.	2	2
					Moderate	26	26	26	204	204	204	204	204	204
					Total	26	26	26	206	206	206	206	206	206
Lower Saxon Creek	Saxon Creek	300	300	300	High	0	0	0	0	0	0	0	0	0
					Moderate	200	200	200	266	266	266	266	266	266
					Total	200	200	200	266	266	266	266	266	266
Hellhole	Trout Creek	300	514	427	High	0	0	0	7	0	0	7	0	0
					Moderate	42	321	242	35	321	242	35	321	242
					Total	42	321	242	42	321	242	42	321	242
Cold Creek	Cold Creek	300	406	300	High	0	0	0	0	0	0	0	0	0
					Moderate	191	230	191	191	230	191	191	232	191
					Total	191	230	191	191	230	191	191	232	191
Total		2,700	3,287	3,009	Totals	1,100 (41%)	1,572 (48%)	1,408 (47%)	1,692 (63%)	2,178 (66%)	2,000 (66%)	1,697 (63%)	2,200 (67%)	2,021 67%)

Total acres of estimated spotted owl nesting, perching, and foraging habitat in HRCAs within the wildlife analysis area would not change by more than nine percent following implementation of either alternative, a result of the design features to retain suitable habitat within HRCAs. Post-treatment acres of high to moderate capability nesting, roosting, and foraging habitats are predicted to be greater than existing conditions for both alternatives. Differences in data sets, as described above, may account for a small portion of the increase in suitable nesting acres. The remainder of the increase in suitable nesting acres reflects the prevalence of understory growth in small diameter trees within HRCAs. Alternative 2 would result in more suitable acres of high and moderate capability spotted owl habitats (CWHR modeling) than Alternative 3. Alternative 3 would also increase predicted acreages of suitable habitats compared to the existing condition, while reducing the number of acres mechanically treated within HRCAs in comparison to Alternative 2.

Table 3-98. Acres of high and moderate capability habitat within California spotted owl HRCAs in the wildlife analysis area by alternative (figures shown for alternatives are post-implementation)

HRCA	Master Owl Territory	HRCA Acres	Habitat Capability	Nesting			Roosting			Foraging		
				Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3
Spring Creek	Tallac Creek	1,000	High	7	7	7	26	136	140	26	136	140
			Moderate	515	795	757	492	668	627	492	692	673
			Total	522	802	764	518	804	767	518	828	813
Tahoe Mountain	Tahoe Mountain	1,000	High	0	0	0	13	33	33	13	33	33
			Moderate	372	643	643	359	611	611	384	634	634
			Total	372	643	643	372	644	644	397	667	667
Echo Lake	Lower Echo	1,000	High	0	0	0	6	7	23	6	7	23
			Moderate	22	3	3	786	739	721	786	739	722
			Total	22	3	3	792	746	744	792	746	745
Hawley Grade	Benwood Meadow	1,000	High	0	0	0	25	25	25	25	25	25
			Moderate	553	608	581	527	583	556	527	594	568
			Total	553	608	581	552	608	581	552	619	593
Round Lake	Round Lake	1,000	High	0	0	0	0	0	0	0	0	0
			Moderate	195	195	195	450	450	450	456	456	456
			Total	195	195	195	450	450	450	456	456	456
Upper Saxon Creek	Saxon Creek	1,000	High	0	0	0	28	28	28	28	28	28
			Moderate	44	44	44	402	402	402	402	402	402
			Total	44	44	44	430	430	430	430	430	430
Lower Saxon Creek	Saxon Creek	1,000	High	0	0	0	10	10	10	10	10	10
			Moderate	732	739	749	803	801	810	803	801	810
			Total	732	739	749	813	811	820	813	811	820
Hellhole	Trout Creek	1,000	High	0	0	0	15	40	40	15	40	40
			Moderate	382	577	543	384	577	543	384	577	543
			Total	382	577	543	399	617	583	399	617	583
Cold Creek	Cold Creek	1,000	High	0	0	0	1	1	1	1	1	1
			Moderate	391	338	378	394	340	380	460	406	446
			Total	391	338	378	395	341	381	461	407	447
Total		9,000	Total	3,212 (36%)	3,949 (44%)	3,900 (43%)	4,722 (52%)	5,451 (61%)	5,400 (60%)	4,818 (54%)	5,581 (62%)	5,554 (62%)

Canopy cover was also used to analyze effects of the proposed action and alternatives on spotted owls and their habitat. Table 3-99 below shows estimated acres with ≥60 percent tree canopy cover and mean tree canopy cover by alternative after implementation for spotted owl PACs in the South Shore wildlife analysis area. Estimates of canopy cover were derived similarly to the estimates of CWHR high and moderate capability habitat above, using the same data sets. Canopy cover would be expected to decline following implementation of Alternatives 2 or 3. However, the source of the decline in canopy cover is important to the predicted suitability of treated stands for spotted owl and other late seral, closed canopy adapted species. A reduction in canopy cover due to the removal of small trees may improve habitat suitability. Estimates of post-treatment CWHR high and moderate capability habitat are a useful cross-reference in determining whether reductions in canopy are likely to be beneficial or detrimental.

For an example of this habitat complexity, in Alternative 2, the Hellhole PAC would have mechanical treatment and PAC size would increase from 300 to 514 acres, with 254 acres treated. Acres of canopy closure ≥60 percent would decline from 280 acres to 147 acres and mean canopy would decline from 64 percent to 57 percent, while CWHR nesting, perching, and foraging habitat would each increase from 42 acres to 321 acres. Comparison of reductions in canopy and gains in suitable habitat suggest that the large gains in habitat are offset by canopy closure reductions of approximately 14 percent (mean canopy cover decrease of seven percent) in treated portions of the PAC. There would be more suitable habitat per acre in the Hellhole PAC, but canopy cover within that suitable habitat would be substantially less than the mean canopy cover (77 percent) observed in nest stands in the Lake Tahoe basin. (Note that habitat is estimated to increase from 42 to 321 acres, an increase of 279 acres, when only 254 acres would be treated; this is likely a product of the differing data sets used to estimate existing and predicted future conditions as discussed above.)

Alternative 3 would retain more acres with ≥60 percent canopy cover and greater mean canopy cover than Alternative 2 because fewer PAC acres would be treated in Alternative 3. Compared to Alternative 2, changes in treatment type, from mechanical to hand thinning, in Alternative 3 did not reduce predicted numbers of acres with ≥60 percent canopy cover or mean canopy cover in spotted owl PACs. Changing treatment types often requires revised treatment prescriptions due to the differences in diameter limits for each treatment type, which are likely to alter resulting stand structure and characterizations of CWHR size and density classes as well as canopy cover.

Table 3-99. Estimated canopy cover (acreage with ≥60 percent tree canopy cover and mean tree canopy cover) for California spotted owl PACs in the wildlife analysis area by alternative (figures shown for alternatives are post-implementation)

PAC	Master Owl Territory	PAC Acres			Acres ≥ 60% Canopy Cover			Mean Canopy Cover		
		Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3
Spring Creek	Tallac Creek	300	300	300	157	115	115	57	57	57
Tahoe Mountain	Tahoe Mountain	300	533	448	52	45	45	52	46	51
Echo Lake	Lower Echo	300	325	325	61	61	61	51	49	49
Hawley Grade	Benwood Meadow	300	309	309	73	58	73	50	42	44
Round Lake	Round Lake	300	300	300	41	41	41	45	45	45
Upper Saxon Creek	Saxon Creek	300	300	300	51	51	51	50	50	50
Lower Saxon Creek	Saxon Creek	300	300	300	49	49	49	54	54	54
Hellhole	Trout Creek	300	514	427	280	147	161	64	57	58
Cold Creek	Cold Creek	300	406	300	183	136	183	58	56	58
	Total	2,700	3,287	3,009	947	703	779			
				Mean	105	78	87	53	51	52

Estimated canopy cover for spotted owl HRCAs in the South Shore wildlife analysis area are shown after implementation by alternative in Table 3-100 below. 50 percent canopy cover for HRCAs, rather than 60 percent in PACs, is a design feature of this project derived from the best available science and management direction for the forest. Canopy cover in HRCAs provides additional information at a larger spatial scale. Increases in numbers of acres with ≥60 percent canopy cover for the Spring Creek and Cold Creek HRCAs are likely artifacts of the methods and data used to estimate canopy cover.

Table 3-100. Estimated canopy cover for California spotted owl HRCAs in the wildlife analysis area by alternative (figures shown for alternatives are post-implementation)

HRCA	Master Owl Territory	HCRA Acres	Acres ≥ 50% Canopy Cover			Mean Canopy Cover		
			Existing	Alt 2	Alt 3	Existing	Alt 2	Alt 3
Spring Creek	Tallac Creek	1,000	612	659	708	51	48	50
Tahoe Mountain	Tahoe Mountain	1,000	435	322	428	47	44	46
Echo Lake	Lower Echo	1,000	382	381	381	46	46	46
Hawley Grade	Benwood Meadow	1,000	413	241	291	47	41	42
Round Lake	Round Lake	1,000	465	465	465	46	46	46
Upper Saxon Creek	Saxon Creek	1,000	338	338	338	45	45	45
Lower Saxon Creek	Saxon Creek	1,000	770	634	632	57	53	53
Hellhole	Trout Creek	1,000	921	739	774	63	56	57
Cold Creek	Cold Creek	1,000	632	656	627	52	52	52
	Total	9,000	4,968	4,435	4,644			
		Mean	552	493	516	51	48	49

A summary of direct and indirect effects of the proposed action and alternatives to spotted owl PACs within the wildlife analysis area is presented below in Table 3-101. The likely contribution of each PAC to spotted owl productivity in the wildlife analysis area was estimated using the method described in the Forest Plan, as amended by the Framework (2004). Using this method, rankings of 1 (lowest contribution to productivity) to 5 (highest contribution to productivity) are determined as follows: 1 = PACs presently unoccupied and historically occupied by territorial singles only; 2 = PACs presently unoccupied and historically occupied by pairs; 3 = PACs presently occupied by territorial singles; 4 = PACs presently occupied by pairs; and 5 = PACs currently or historically reproductive. Estimates of relative contribution to productivity are intended to identify relative probability of territory occupancy, reproduction, and fledging, and level of risk associated with entering a territory to conduct management activities with a higher level of risk associated with managing more frequently occupied territories compared to moderately or infrequently-occupied territories. The phases of implementation during which treatments would occur in a PAC are also included in the summary of direct and indirect effects to spotted owl PACs in Table 3-101. For the proposed action (Alternative 2) and Alternative 3, where treatment stands are located in close proximity to one another, vegetation treatments within those stands would be separated in time where possible, in order to provide refuge for wildlife during implementation by avoiding simultaneous treatment of all PAC acres within an owl territory. Scheduling treatments over time would also minimize the level of localized effects in any given year for other resources.

A summary of direct and indirect effects to spotted owl HRCAs within the wildlife analysis area from the action alternatives is presented below in Table 3-102. The likely contribution of each HRCA to spotted owl productivity in the wildlife analysis area was estimated using the method described for PACs in the Forest Plan, as amended by the Framework (2004). Activity in PACs (Table 3-85) was used to determine activity in corresponding HRCAs. The phases of implementation during which treatments would occur in an HRCA are also included in the summary of direct and indirect effects to spotted owl PACs in Table 3-101. Where treatment stands are located in close proximity to one another, vegetation treatments within those stands would be separated in time where possible to provide refuge for wildlife during implementation and to manage potential impacts to other resources, minimizing the level of localized effects in any given year.

Table 3-101. Summary of direct and indirect effects of the proposed action and alternatives to California spotted owls and their habitat within wildlife analysis area PACs

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
Spring Creek	Tallac Creek	High risk of direct effects to individuals in this recently occupied PAC. Moderate risk of direct effects to reproduction in this historically (2002) reproductive PAC as the nest stand is located within treatment units. 15% of existing PAC would be treated in 2nd and 3rd phases of implementation. Nesting habitat decreased by two acres. Roosting and foraging habitats increased from 86% to 90% and increased from 259 acres to 270 acres. Canopy cover ≥60% reduced from 157 acres to 115 acres, but mean canopy cover not affected.	Same as Alternative 2 except that an estimated 8 additional acres of moderate capability nesting habitat would result.
Tahoe Mountain	Tahoe Mountain	High risk of direct effects to individuals in this recently occupied PAC. Low risk to reproduction (currently occupied by an owl pair but reproduction not detected to date). 100% of existing PAC would be treated in 2nd, 3rd, and 4th phases of implementation. Proportion of nesting and roosting habitats reduced from 75% to 65%, but increased from 224/225 (nesting/roosting) acres to 347 acres. Proportion of foraging habitats reduced from 75% to 68%, but increased from 225 acres to 362 acres. Canopy cover reduced from 52% to 46%. PAC was remapped into this location after the Angora Fire.	Same as Alternative 2 except that 85 acres of mechanical thinning would be switched to hand thinning, reducing risk of direct and indirect effects to individuals. Proportion of nesting and roosting habitats reduced from 75% to 70%, but increased from 224/225 (nesting/roosting) acres to 314 acres. Proportion of foraging habitats reduced from 75% to 74%, but increased from 225 acres to 330 acres. Canopy cover reduced from 52% to 51%.
Echo Lake	Lower Echo	Low risk of direct effects to individuals in this unoccupied PAC. Low risk to reproduction (no pairs or nests known). 16% of existing PAC would be treated in 1st and 2nd phases of implementation. Proportion of nesting habitat decreased from 2% to 1% and acres decreased from 5 acres to 2 acres. Proportion of roosting and foraging habitats decreased from 84% to 77% and decreased from 251 acres to 250 acres. Canopy cover reduced from 51% to 49%.	Same as Alternative 2 except that 2 fewer acres of roosting and foraging habitat would result.
Hawley Grade	Benwood Meadow	High risk of direct effects to individuals in this recently occupied PAC. Moderate risk of direct effects to reproduction in this historically (2000) reproductive PAC as the nest stand is located within treatment units. 29% of existing PAC would be treated in all phases of implementation. Proportion of nesting, roosting, and foraging habitats increased from 49% to 59% and acres increased from 147 acres to 183 acres. Canopy cover reduced from 50% to	Same as Alternative 2 except that 61 acres of hand thinning would be eliminated (9% of existing PAC would be treated), reducing risk of direct and indirect effects to individuals. Nest stand not treated, reducing risk (low risk) of direct and indirect effects to reproduction. Proportion of nesting, roosting, and foraging habitats increased from 49% to 51% and increased from 147 acres to 158 acres. Canopy cover reduced from 50%

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
		42%.	to 44%.
Round Lake	Round Lake	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Upper Saxon Creek	Saxon Creek	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Lower Saxon Creek	Saxon Creek	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Hellhole	Trout Creek	Low risk of direct effects to individuals in this unoccupied PAC. Low risk to reproduction (historically occupied by an owl pair but reproduction not detected to date). 85% of existing PAC would be treated in all phases of implementation. Proportion of nesting, roosting, and foraging habitats increased from 14% to 62% and increased from 42 acres to 321 acres. Canopy cover ≥60 percent reduced from 280 acres to 147 acres and mean canopy cover reduced from 64% to 57%.	Same as Alternative 2 except that 14 acres of mechanical thinning switched to hand thinning and 73 acres of mechanical thinning would be eliminated from treatment (61% of existing PAC would be treated), reducing risk of direct and indirect effects to individuals. Proportion of nesting, roosting, and foraging habitats increased from 14% to 56% and acres of nesting habitat increased from 42 acres to 242 acres. Canopy cover ≥60 percent reduced from 280 acres to 161 acres and mean canopy cover reduced from 64% to 58%.
Cold Creek	Cold Creek	High risk of direct effects to individuals in this recently occupied PAC. Very high risk of direct effects to reproduction in this recently (fledged 3 young in 2006) reproductive PAC as the nest stand is located within treatment units. 35% of existing PAC would be treated in 3rd and 4th phases of implementation. Proportion of nesting and foraging habitats decreased from 64% to 57%, but increased from 191 acres to 230 acres. Foraging habitat increased by an additional 2 acres. Canopy cover ≥60 percent reduced from 183 acres to 136 acres and mean canopy cover reduced from 58% to 56%.	Not treated: no direct, indirect, or cumulative effects would occur.

Table 3-102. Summary of direct and indirect effects of the proposed action and alternatives to California spotted owls and their habitat within wildlife analysis area HRCAs

HRCA	Territory	Proposed Action (Alternative 2)	Alternative 3
Spring Creek	Tallac Creek	High risk of direct effects to individuals in this recently occupied HRCA. Moderate risk of direct effects to reproduction in this historically (2002) reproductive HRCA as the nest stand is located within treatment units. 54% of HRCA would be treated in all implementation phases. Nesting habitat increased from 522 acres to 802 acres. Roosting habitat increased from 518 acres to 804 acres. Foraging habitat increased from 518 acres to 828 acres. Canopy cover ≥50% increased from 612 acres to 659 acres, but mean canopy cover reduced from 51% to 48%.	Same as Alternative 2 except that 206 acres of mechanical thinning would be switched to hand thinning and 6 acres would be eliminated from treatment, reducing risk of direct and indirect effects to individuals. Nesting habitat increased from 522 acres to 764 acres. Roosting habitat increased from 518 acres to 767 acres. Foraging habitat increased from 518 acres to 813 acres. Canopy cover ≥50% increased from 612 acres to 708 acres, but mean canopy cover reduced from 51% to 50%.
Tahoe Mountain	Tahoe Mountain	High risk of direct effects to individuals in this recently occupied HRCA. Low risk to reproduction (currently occupied by an owl pair but reproduction not detected to date). 92% of HRCA would be treated in all implementation phases. Nesting habitat increased from 372 acres to 643 acres. Roosting habitat increased from 372 acres to 644 acres. Foraging habitat increased from 397 acres to 667 acres. Canopy cover ≥50% decreased from 435 acres to 322 acres and mean canopy cover reduced from 47% to 44%. HRCA was remapped into this location after the Angora Fire.	Same as Alternative 2 except that 240 acres of mechanical thinning would be switched to hand thinning and 21 acres would be eliminated from treatment (90% of HRCA would be treated), reducing risk of direct and indirect effects to individuals. Canopy cover ≥50% decreased from 435 acres to 428 acres and mean canopy cover reduced from 47% to 46%. HRCA was remapped into this location after the Angora Fire.
Echo Lake	Lower Echo	Low risk of direct effects to individuals in this unoccupied HRCA. Low risk to reproduction (no pairs or nests known). 15% of HRCA would be treated in 1st and 2nd phases of implementation. Nesting habitat decreased from 22 acres to 3 acres. Roosting and foraging habitat decreased from 792 acres to 746 acres. Canopy cover ≥50% decreased from 382 acres to 381 acres and mean canopy cover unaffected at 46%.	Same as Alternative 2 except that 1 acre of hand thinning would be switched to mechanical thinning and 7 acres would be eliminated from treatment (14% of HRCA would be treated), slightly reducing risk of direct and indirect effects to individuals. Roosting and foraging habitat decreased from 792 acres to 744 acres.
Hawley Grade	Benwood Meadow	High risk of direct effects to individuals in this recently occupied HRCA. Moderate risk of direct effects to reproduction in this historically (2000) reproductive HRCA as the nest stand is located within treatment units. 23% of HRCA would be treated in all implementation phases. Nesting habitat increased from 553 acres to 608 acres. Roosting habitat increased from 552 acres to 608 acres. Foraging habitat increased from 552 acres to 619 acres. Canopy cover ≥50% decreased from 413 acres to 241 acres and	Same as Alternative 2 except that 5 acres of hand thinning would be switched to mechanical thinning and 63 acres would be eliminated from treatment (17% of HRCA would be treated), slightly reducing risk of direct and indirect effects to individuals. Nesting habitat increased from 553 acres to 581 acres. Roosting habitat increased from 552 acres to 581 acres. Foraging habitat increased from 552 acres to 593 acres. Canopy cover ≥50% decreased from 413 acres to 291 acres and mean canopy cover

		mean canopy cover decreased from 47% to 41%.	decreased from 47% to 42%.
Round Lake	Round Lake	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Upper Saxon Creek	Saxon Creek	Not treated: no direct, indirect, or cumulative effects would occur.	Not treated: no direct, indirect, or cumulative effects would occur.
Lower Saxon Creek	Saxon Creek	High risk of direct effects to individuals in this recently occupied HRCA. Moderate risk of direct effects to reproduction in this recently (2007) reproductive HRCA as the nest stand is located approximately 0.5 mile from treatment units. 25% of HRCA would be treated in all implementation phases. Nesting habitat increased from 732 acres to 739 acres. Roosting and foraging habitat decreased from 813 acres to 811 acres. Canopy cover ≥50% decreased from 770 acres to 634 acres and mean canopy cover decreased from 57% to 53%.	Same as Alternative 2 except that 4 acres of mechanical thinning would be switched to hand thinning and 11 acres would be eliminated from treatment (23% of HRCA would be treated), reducing risk of direct and indirect effects to individuals. Nesting habitat increased from 732 acres to 749 acres. Roosting and foraging habitat increased from 813 acres to 820 acres. Canopy cover ≥50% decreased from 770 acres to 632 acres.
Hellhole	Trout Creek	Low risk of direct effects to individuals in this unoccupied HRCA. Low risk to reproduction (historically occupied by an owl pair but reproduction not detected to date). 56% of HRCA would be treated in all phases of implementation. Nesting habitat increased from 382 acres to 577 acres. Roosting and foraging habitat increased from 399 acres to 617 acres. Canopy cover ≥50% decreased from 921 acres to 739 acres and mean canopy cover decreased from 63% to 56%.	Same as Alternative 2 except that 146 acres of mechanical thinning would be switched to hand thinning and 108 acres would be eliminated from treatment (45% of HRCA would be treated in 1st, 3rd, and 4th phases of implementation), reducing risk of direct and indirect effects to individuals. Nesting habitat increased from 382 acres to 543 acres. Roosting and foraging habitat increased from 399 acres to 583 acres. Canopy cover ≥50% decreased from 921 acres to 774 acres and mean canopy cover decreased from 63% to 57%.
Cold Creek	Cold Creek	High risk of direct effects to individuals in this recently occupied HRCA. Very high risk of direct effects to reproduction in this recently (fledged 3 young in 2006) reproductive HRCA as the nest stand is located within treatment units. 35% of HRCA would be treated all phases of implementation. Nesting habitat decreased from 391 acres to 338 acres. Roosting habitat decreased from 395 acres to 341 acres. Foraging habitat decreased from 460 acres to 407 acres. Canopy cover ≥50% increased from 632 acres to 656 acres and mean canopy cover unaffected at 52%.	Same as Alternative 2 except that 222 acres would be eliminated from treatment (13% of HRCA would be treated in 2nd, 3rd, and 4th phases of implementation), reducing risk of direct and indirect effects to individuals. Nesting habitat decreased from 391 acres to 378 acres. Roosting habitat decreased from 395 acres to 381 acres. Foraging habitat decreased from 460 acres to 447 acres. Canopy cover ≥50% decreased from 632 acres to 627 acres.

California Spotted Owl Cumulative Effects

Alternative 1

No direct or indirect effects are expected; therefore no cumulative effects are expected.

Alternative 2

Six of eight (75%) territories (six of nine PACs) within the wildlife analysis area would be treated, at least in part, by the proposed action. The anticipated effects within each territory are generally characterized as short term disturbance transitioning to long term benefit for the species and its habitat. The combined effect of the proposed action to spotted owls and their habitat within these territories may be similarly characterized: short term disturbance to the spotted owl population and habitat followed by long term benefit. The cumulative effect of the proposed action, when combined with past, present, and reasonably foreseeable future actions is to adversely affect individual spotted owls and a portion of the suitable habitat present in the wildlife analysis area (as described above) during and immediately following implementation, followed by benefits to spotted owls and their habitat in the wildlife analysis area as stands mature during the 15-year period following implementation. The PAC and nest stand that would be treated in Alternative 2, but not Alternative 3 would likely benefit from treatment more than 15-years after implementation. Six of 19 (32%) territories (six of 21 PACs) within the Lake Tahoe basin and less than one percent of spotted owl territories in the Sierra Nevada would be affected.

Alternative 3

Six of eight (75%) territories (five of nine PACs) within the wildlife analysis area would be treated, at least in part, by the proposed action. Less risk to high quality territories would occur because the Cold Creek PAC and Hawley Grade nest stand would not be treated. Survival and reproduction of spotted owls within the wildlife analysis area would likely be increased relative to Alternative 2 during and immediately following implementation. The effects of Alternative 3 are expected to be more beneficial than those described above for Alternative 2. Six of 19 (32%) territories (five of 21 PACs) within the Lake Tahoe basin and less than one percent of spotted owl territories in the Sierra Nevada would be affected.

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the California spotted owl.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore project EIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the California spotted owl. rationale:

- Effects to California spotted owls are expected to transition from adverse disturbance-type effects during implementation toward beneficial habitat maturation-type effects over the 15-year period following implementation
- Initial reductions in suitable California spotted owl habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories
- Project implementation, in the context of the wildlife analysis area, is expected to benefit California spotted owls and their habitat in the long term

Great Gray Owl

The great gray owl (*Strix nebulosa*) is a Forest Service Sensitive (S) species on the Lake Tahoe Basin Management Unit. Current management direction for this species is set forth in the Land

and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Great Gray Owl Existing Conditions

Great gray owls have a world-wide arctic and boreal forest distribution, occurring "south of the tree line in northern Yukon, northwest and central Mackenzie River basin (Lockhart River and Great Slave Lake), north Saskatchewan, Manitoba, north Ontario south through southern Yukon and interior British Columbia, north and central Alberta, Manitoba, and central Ontario" (Godfrey 1986, as summarized in USDA FS 2004). "In the U.S. its range includes Alaska, Washington, northern Idaho, western Montana south through the Cascade and Sierra Nevada ranges to east-central California, west-central Nevada, and northwest Wyoming" (USDA FS 2004). Population levels throughout the range are known to be highly variable. The population in the Sierra Nevada is the southernmost in the world and is separated from populations in the remainder of the range. Great gray owls are thought to occur throughout the Sierra Nevada range though local distribution may be highly variable. Core areas identified include Yosemite National Park and adjacent areas on the Sierra and Stanislaus National Forests. Nesting in Sequoia National Park likely continues, but had not been confirmed since 2001 (Sears 2006). Within the Yosemite core area, this species generally occurs between 2,500-8,900 feet (750-2,700 meters) elevation (summarized in Sears 2006) though this likely varies by latitude (USDA FS 2004). Breeding in California occurs from 2,500-8,000 feet (750-2,440 meters) elevation (Green 1995 in USDA FS 2004).

Surveys for great gray owls detected this species on the Eldorado, Stanislaus, Sierra, and Tahoe National Forests but not on the Plumas or Sequoia National Forests. Surveys for great gray owl have not been conducted on the LTBMU; nor have detections occurred despite extensive surveys for California spotted owl over the past 20+ years. The nearest detection of this species to the Lake Tahoe basin occurred near Carson Pass in 1971 approximately 1.1 miles south of the analysis area. A second great gray owl detection was reported near Grover Hot Springs State Park, approximately 7.9 miles southeast of the analysis area, in 1979. Based on the lack on detections on the Forest and the presumption that this species likely would have been detected if it were present; the great gray owl appears to be absent from the Lake Tahoe basin, or to occur rarely or at extremely low densities. There are no PACs for great gray owls on the LTBMU or within the wildlife analysis area.

Great gray owls typically forage in meadows and early seral-stage habitats that support sufficient prey, primarily mice (*Microtus)* and voles (*Thomomys* spp.) (USDA FS 2004, Sears 2006). Nesting and roosting occur in adjacent conifer forests, generally in areas where canopy cover averages greater than 40 percent (USDA FS 2004). Nests surveyed by Sears (2006) were located within 200-300 meters of associated foraging meadows and roosts were located within 10-100 meters. Persistently occupied nests were generally associated with meadows larger than 25 acres in the Yosemite area though smaller meadows (as small as 10 acres) "supported infrequent nesting" (Ibid). This species nests in disused hawk and raven stick nests, natural depressions in broken top snags and stumps, dwarf-mistletoe platforms, and, rarely, on the ground, rock cliffs, or haystacks (summarized in Hayward and Verner et al. 1994). Great gray owls do not build or add materials to the nest; and their nests may occur in close proximity; the closest distance observed between nests was 1,410 feet (Bull and Henjum 1990). Nest sites on the Stanislaus National Forest and in Yosemite National Park were in trees larger than 30 inches dbh and in stands that averaged greater than 70 percent canopy cover. Suitability of foraging meadows depended primarily upon prey availability, meadow vegetation height and cover, and meadow soil moisture (Sears 2006).

In California, courtship starts in late February or March, eggs are laid in late March or April, incubation lasts 30-36 days, and fledging occurs mid-May to mid-June; however, these dates vary by latitude, elevation, and spring climate conditions (Bull and Henjum 1990, USDA FS 2004). Both parents typically tend the young during the post-fledging dependency period. Adults defend nests and young aggressively. Most juveniles remain near the natal site, but dispersal distances of up to 468 miles have been recorded. Nesting density varies substantially by area: 0.29 pairs/square mile (mi^2) in Oregon and 0.66 pairs/mi^2 in Manitoba (Bull and Henjum 1990); 0.73 pairs/mi^2 in Minnesota (Duncan 1987); and 0.25 pairs/mi^2 in California (Winter 1986) (summarized in USDA FS 2004).

High and moderate capability nesting and roosting habitat is defined as all forest vegetation types in CWHR size and density classes 4M, 4D, 5M, 5D, and 6 (USDA FS 2004). CWHR describes high capability habitats in greater detail, but does not identify moderate capability habitats. For the purposes of this analysis, high capability nesting and roosting habitats include those identified as such by CWHR and moderate capability nesting and roosting habitats include all forest vegetation types in size and density classes not considered high capability by CWHR.

Given the known elevation range for this species in the Sierra Nevada and latitude of the Basin, high and moderate capability nesting habitat within the Lake Tahoe basin is not likely to occur above 8,000 feet. CWHR describes high capability foraging habitat as high capability roosting habitat plus the Wet Meadow (all strata) vegetation type; CWHR does not identify moderate capability foraging habitat. For the purposes of this analysis, high capability foraging habitat includes those identified as such by CWHR below 8,900 feet elevation (as described in Sears 2006), and moderate capability foraging habitat includes the same habitats located above 8,900 feet elevation.

Estimated acres of high and moderate capability nesting habitat, acres of high and moderate capability roosting habitat, and acres of high and moderate capability foraging habitat currently existing for great gray owl within the wildlife analysis area are shown in Table 3-103.

Table 3-103. Existing acres of high and moderate capability great gray owl habitat within the project wildlife analysis area

Habitat Capability	Nesting Habitat	Roosting Habitat	Foraging Habitat
High	52	18,723	21,232
Moderate	18,563	4,822	190
Total	18,615	23,545	21,422

Great Gray Owl Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Conifer encroachment of suitable meadow habitat would continue. Wildland fire would continue to threaten this species habitat. Great gray owls would continue to be extirpated from or occur in extremely low densities within the wildlife analysis area. Suitable great gray owl habitats would not be affected by this alternative. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Great gray owls are not known to be particularly susceptible to anthropogenic disturbance, suggesting that suitable habitats could be occupied in the WUI where either of the proposed action alternatives would occur. However, this species has not been detected in the wildlife analysis area and is thought to be extirpated from the Lake Tahoe basin or occur in extremely low densities. Therefore, effects to great gray owls are unlikely to occur, but could include displacement of individuals (e.g., equipment flushing an individual) or changes in patterns of habitat use (e.g., avoidance of areas with ongoing project activities). Survival is unlikely to be affected as individuals of this species would be expected to avoid project activities. Great gray owl reproduction is also unlikely to be affected as no pairs or territories are known within treatments stands or the wildlife analysis area and because project design features specify protective measures (e.g., designation of a PAC or implementation of an LOP) in the event that a great gray owl pair, juveniles, or nest is discovered prior to project implementation.

Great gray owl habitat occurs within the project area as described above. The estimated number of acres of high and moderate capability great gray owl nesting, roosting, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-104. Total existing acres of these habitats within the wildlife analysis area are appended for comparison. Alternatives 2 and 3 would reduce great gray owl nesting, roosting, and foraging habitats by an estimated 2,103 acres (Alternative 2) or 1,798 acres (Alternative 3). High and moderate capability nesting habitat available within the wildlife analysis area (18,615 acres) would be reduced by approximately 11 percent in Alternative 2 and 10 percent in Alternative 3.

No PACs would be affected as none have been designated within the wildlife analysis area or on the LTBMU. Available roosting habitat (23,545 acres) would decrease by approximately nine percent in Alternative 2 and eight percent in Alternative 3. Available foraging habitat (21,422 acres) would decrease by approximately 10 percent in Alternative 2 and eight percent in Alternative 3. High capability nesting habitat would be reduced by an estimated 70 acres, slightly more than was estimated to currently exist in the wildlife analysis area. A similar situation for moderate capability foraging habitat (more than the existing, estimated 190 acres to be removed) is also apparent. These discrepancies are likely due to differences in the data sets used as described for northern goshawk and spotted owl above. Either existing habitats are underestimated or reductions in suitable habitat predicted to occur from project implementation are overestimated. In either case, effects to great gray owl habitat appear slightly exaggerated. Treated stands and meadows would be expected to mature along trajectories beneficial to great gray owl (e.g., increasing herbaceous cover in meadows and improving canopy structure and cover toward CWHR 4M, 4D, 5M, 5D, and 6 size and density classes) during the 15 years after implementation. Increased herbaceous cover in meadows would likely increase prey species (e.g., meadow vole) populations. Stand treatments would also increase stand resistance to drought, insects, disease, and fire benefiting great gray owl habitats. The potential of Alternative 3 to affect great gray owls or their habitat is expected to be slightly less than Alternative 2 because the former alternative would treat fewer acres of suitable habitats. The action alternatives would affect approximately eight to 11 percent of suitable great gray owl habitats within the wildlife analysis area.

Table 3-104. Estimated acres of high and moderate capability great gray owl habitat within the project area before and after implementation of the Action Alternatives in comparison to the wildlife analysis area

	Habitat Capability	Nesting Habitat		Roosting Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	70 / 0	-70	5,533 / 3,847	-1,686	5,533 / 3,847	-1,686
	Moderate	7,061 / 5,028	-2,033	1,606 / 1,189	-417	1,606 / 1,189	-417
	Total	7,131 / 5,028	-2,103	7,139 / 5,036	-2,103	7,139 / 5,036	-2,103
Alternative 3	High	70 / 0	-70	5,328 / 3,,884	-1,444	5,328 / 3,,884	-1,444
	Moderate	6,543 / 4,815	-1,728	1,293 / 939	-354	1,293 / 939	-354
	Total	6,613 / 4,815	-1,798	6,621 / 4,823	-1,798	6,621 / 4,823	-1,798
Wildlife Analysis Area	High	52		18,723		21,232	
	Moderate	18,563		4,822		190	
	Total	18,615		23,545		21,422	

Great Gray Owl Cumulative Effects

Alternative 1

No direct or indirect effects would occur; therefore no cumulative effects would occur.

Alternative 2

The proposed action, when combined with past, present, and reasonably foreseeable future actions is not expected to have a cumulative effect to great gray owl because the risk of potential disturbance-type effects is low since this species has not been detected within the analysis area. No negative cumulative effect to great gray owl habitat is expected because the proposed action, in concert with other actions (i.e., Cookhouse Meadow, Big Meadow, Upper Truckee River restoration projects), would reduce conifer encroachment in meadows, increase suitable meadow habitat, and maintain suitable forested habitats adjacent to meadows within the wildlife analysis area. Increases in the quality and quantity of meadow and adjacent forested stand habitats are expected during the 15 years following project implementation as more meadows are restored and stands mature.

Alternative 3

Cumulative effects for Alternative 3 are the same as those for Alternative 2 except that the scope of effects is slightly reduced as fewer acres would be treated and more acres of suitable great gray owl nesting, roosting, and foraging habitat would be retained.

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the great gray owl.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore project EIS may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the great gray owl rationale:

- This species has not been detected within the wildlife analysis area
- Disturbance-type effects (e.g., equipment flushing an individual) are unlikely, but may occur during implementation
- Approximately 89% to 91% of nesting, roosting, and foraging habitats within the wildlife analysis area would be retained for Alternative 2
- Approximately 90% to 92% of nesting, roosting, and foraging habitats within the wildlife analysis area would be retained for Alternative 3
- Conifer encroachment in meadows would be reduced, contributing to potential prey abundance

Willow Flycatcher

The willow flycatcher (*Empidonax trailii*) is a Forest Service Sensitive (S) species on the Lake Tahoe Basin Management Unit. Current management direction for this species is set forth in the Land and Resource Management Plan (USDA FS 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004b).

Willow Flycatcher Existing Conditions

Except for the Southeast, this neotropical migrant species breeds within the contiguous United States and the southern margins of Canada (Green et al. 2003) and winters from Mexico to northern South America (USDA FS 2001). Three subspecies occur in California: *E. t. extimus* (southern California), *E. t. brewsteri* (north of Fresno County from the Pacific coast to the western slopes of the Sierra Nevada crest), and *E. t. adastus* (on the eastern slopes of the Sierra Nevada and Cascade ranges, including the Lake Tahoe basin) (USDA FS 2000 and Greene et al. 2003). The subspecies *E. t. adastus* occurs and breeds on the LTBMU from May through September (Ibid) and winters from the Mexican state of Colima to northwestern Venezuela (Unitt 1999 in USDA FS 2001).

Historically, this species likely occurred in suitable habitats throughout California (Grinnell and Miller 1944) and portions of Nevada including the central coast, Central Valley, Sierra Nevada, and Great Basin (USDA FS 2001). Willow flycatchers were common in the Sierra Nevada until as recently as 1910 and locally abundant through 1940 (Ibid). However, this species has declined precipitously in the Sierra Nevada since 1950 (summarized in Green et al. 2003). Urbanization and the draining, channelization, and filling of wetlands, grazing, mining, and pesticide-use are likely responsible for the decline in range and abundance of this species. Much of the suitable habitat within the Lake Tahoe basin has been developed since 1900; as much as 35 percent of streamside zones, 50 percent of meadows, and 75 percent of marshes were estimated to have been lost to development by 2001 (USDA FS 2001). However, since 2001 several large-scale meadow and riparian restoration projects (e.g., Cookhouse Meadow, Big Meadow, Washoe State Park, Upper Truckee River, Taylor-Tallac, High Meadows, Meeks Bay, Blackwood, and Antone Meadows) have or will soon be restoring willow flycatcher habitats. Livestock grazing has been essentially eliminated in the Lake Tahoe basin, assisting in the restoration of primary habitat for the species.

Willow flycatchers currently occur and breed in areas (e.g., Upper Truckee River watershed) where they were thought to have “all but disappeared” (USDA FS 2001), though at very low densities and with limited reproductive success. The recent extirpation of this species from Yosemite National Park, where suitable habitats are presumably better preserved than those located outside the park suggests that other factors may be contributing to the decline of this species in the Sierra Nevada (Siegel et al. 2008). Siegel et al. (Ibid) tentatively suggested that severe habitat degradation during the 19th century (due to grazing, which was discontinued in Yosemite National Park decades ago), meadow desiccation (due to global warming and resulting in earlier spring melts and a reduction in site wetness), disrupted meta-population dynamics, or conditions on the wintering grounds or along migration routes may explain the decline in Yosemite National Park.

The combination of resources and environmental conditions required to survive and reproduce for this species in the Sierra Nevada is defined by site elevation, shrub coverage, foliar density, wetness, and meadow size (summarized in Green et al. 2003). Known willow flycatcher sites range in elevation from 1,200 to 9,500 feet, though most (88%) are located between 4,000 and 8,000 feet (Stefani et al. 2001). Willow flycatchers are closely associated with meadows that have high water tables in the late spring and early summer, and abundant shrubby, deciduous vegetation (especially willows.). Shrubs in these preferred habitats are typically 6.5 to 13 feet in height, with the lower half comprised of dense woody stems. Live foliage density within the shrub layer is moderate to high and uniform from the ground to the shrub canopy (summarized in USDA FS 2001). Sites are "significantly more likely to support multiple willow flycatchers, and result in successful breeding efforts, as riparian shrub cover in meadows and willow flycatcher territories increase" (Bombay 1999 in USDA FS 2001).

This species prefers and is more likely to occupy and defend territories that have standing water or saturated soils during the breeding season, often selecting the wettest portions within meadows (USDA FS 2001). Occupied meadows range in size from less than 1.0 acre to 716 acres, averaging approximately 80 acres (USDA FS 2001). More than 95 percent of breeding meadows are larger than 10 acres, and meadows where multiple nest sites have fledged young are larger than 15 acres (Green et al. 2003). This species exhibits some site fidelity; 15 percent of adult banded birds in the Sierra Nevada in 1997 and 1998 returned in a subsequent year, compared to 31 percent at the Kern River Preserve in California, and 50 percent at Malheur National Wildlife Refuge in south-eastern Oregon (Bombay et al. 2003). Site fidelity for wintering grounds in Costa Rica averaged 68 percent (Koronkiewicz et al. 2006).

The CWHR model describes high to moderate capability nesting habitats, high to moderate capability perching habitats, and high capability foraging habitat in the montane riparian and wet meadow vegetation types for this species. However, as the CWHR model is not subspecies-specific and the local subspecies, *E. t. adastus*, is known to nest only in wet meadows in the wildlife analysis area, high and moderate capability nesting habitat includes only the wet meadow vegetation type for the purposes of this analysis. Similarly, as *E. t. adastus* nests locally in wet meadows, high and moderate capability perching habitat includes wet meadow and montane riparian vegetation types. High capability foraging habitat, as described in CWHR, includes montane riparian and wet meadow for this analysis.

Estimated acres of high and moderate capability nesting habitat, acres of high and moderate capability perching habitat, and acres of high and moderate capability foraging habitat currently existing for willow flycatcher within the wildlife analysis area are given in Table 3-105.

Table 3-105. Existing acres of high and moderate capability willow flycatcher habitat within the project wildlife analysis area

Habitat Capability	Nesting Habitat	Perching Habitat	Foraging Habitat
High	2,727	2,727	2,727
Moderate		78	78
Total	2,727	2,805	2,805

In the Lake Tahoe basin, the breeding season generally occurs from late May or early June, when breeding birds arrive and establish territories, until the fledgling dependency periods ends in the middle of September. Sanders and Flett (1989) reported the average territory size for a paired male willow flycatcher as approximately 0.84 acres in the central Sierra Nevada. This species typically nests from June 1 to August 31 and fledges young between July 15 and August 31. Fledglings remain in territories for 2-3 weeks after fledging (USDA FS 2004). However, these dates vary due to factors such as when willow flycatchers arrive on the breeding grounds, snow pack, late spring and summer weather, nest predation, and brown-headed cowbird parasitism (Green et al. 2003).

This species may attempt nesting as many as three times during a single breeding season in the Sierra Nevada (USDA FS 2004). Nest predation has been positively associated with edge-effects, distance of the nest to edges and isolated trees, and aspects of meadow size and wetness (Cain et al. 2003). Meadow restoration that includes restoring natural hydrologic regimes, mitigating erosion, and stemming forest encroachment was suggested to reduce predation of willow flycatcher nests (Green et al. 2003). Nest parasitism by brown-headed cowbirds in the Sierra Nevada ranges from a low of 4 percent (Bombay et al. 2001) to a high of 66 percent (Whitfield and Sogge 1999). Cowbird parasitism rates in the Lake Tahoe basin were estimated at 44 percent (Morrison et al. 2000) and later found to be locally as high as 47 percent (Upper Truckee River drainage). Conservation concerns begin at parasitism rates of approximately 30 percent (Mayfield 1977 and Laymon 1987 in Green et al 2003) and management actions to control cowbirds may be warranted above a 60 percent parasitism rate (USDA FS 2004).

Willow flycatchers are insectivorous and known to hawk prey in flight and to glean prey from foliage during flight. Foraging occurs from perches within the territory. Average foraging flights are reported to be very short (mean=13 feet, range=up to 33 feet) (Sanders and Flett 1989).

Surveys for this species were conducted in the wildlife analysis area in 2006 and 2007 following the USFS, Region 5, "Willow Flycatcher Survey Protocol for California" (Bombay et al. 2003). An estimated total 381 acres (approximately 219 acres for the South Shore project and an additional 162 acres for other projects) were surveyed for willow flycatcher within the wildlife analysis area in 2006 and 2007. In addition, a long-term willow flycatcher survey history (15+ years) exists in the wildlife analysis area. The results of the project-specific, concurrent and historic surveys are considered in this analysis.

The LTBMU participates in the central Sierra Nevada willow flycatcher demography study led by the Tahoe National Forest. Information regarding population, territory, and nest monitoring for willow flycatchers in the Lake Tahoe basin is derived from this collaborative effort (Mathewson et al. 2007). The long-term demographic research is conducted from Highway 88 in Alpine County north to Lassen Volcanic National Park. Sites north of the Feather River, in Plumas County are the north sites; central sites extend south to the mid-latitude of Lake Tahoe; and the south sites comprise the remainder, including the wildlife analysis area. The number of territories in the north region fluctuated, the central region remained relatively stable from 2002 to 2007; and the number of territories in the south declined over the last 11 years. Mean annual nest success for 1997 to 2007 was 40 percent, ranging from 22 to 50 percent. Mean annual reproduction rate was 1.52 fledglings/female. Mean annual juvenile recruitment was 19.5 percent. Mean annual adult survival was 65.1 percent (Ibid). Mathewson et al. (2007) estimated that the rate of population change (λ) is 0.856 or a 14.4 percent annual decline.

Table 3-106 provides a summary of information for historically and recently occupied willow flycatcher habitats within the South Shore wildlife analysis area.

Table 3-106. Summary of historically and recently occupied willow flycatcher habitats within the wildlife analysis area

Survey Area	Willow flycatcher nesting, fledging, and occupancy detected in survey area	Detection in Survey area 2005-2007	Contribution to productivity[a]	Treated in Alternative	
				2	3
Tallac Creek	1992-95: surveyed, but no detections 1996: not surveyed 1997: surveyed, but no detections 1998-2000: not surveyed 2003: (original detection) 1 territory; 1 adult; no nests or fledglings 2004: 2 territories; 4 adults; 3 nests (1 re-nest, 1 failed, 1 successful); fledged at least 1 (up to 3 may have fledged) 2005: 3 territories; 3 adults; 1 nest; 2 fledged 2006: 2 territories; 2 adults; no nesting or juveniles 2007: 2 territories; 2 adults; no nesting or juveniles	Yes	5	No	No
Taylor Creek	1992: (original detection) 2 territories; 3 adults; no nests or fledglings 1993-95: surveyed, but no detections 1996: not surveyed 1997-98: surveyed, but no detections 1999-2000: not surveyed 2001: 1 adult (non-territorial); no nests or fledglings 2001-2007: surveyed, but no detections	No	2	No	No
Lily Lake	2002: (original detection – incidental) 1 adult (non-territorial); no nests or fledglings 2003: 1 territory; 1 adult; no nests or fledglings 2004-07: surveyed, but no detections	No	1	Yes	Yes
Washoe Meadows	1992-93: not surveyed 1994: surveyed, but no detection 1995-97: not surveyed 1998: (original detection) 1 territory, 2 adults; 2 nests; no fledglings 1999-2007: surveyed, but no detections	No	5	No	No
Morton Street	1992-97: not surveyed 1998: (original detection) 1 adult; no nest or fledglings 1999-2007: surveyed, but no detections	No	1	No	No
Uppermost Upper Truckee	1992-96: not surveyed 1997: 1 adult (non-territorial; original detection); no nests or fledglings 1998: 3 territories; 6 adults; 6 nests (4 failed); at least 2 fledged	Yes	5	No	No

	1999: 3 territories; 6 adults; 7 nests (6 failed); fledged at least 1 2000: 3 territories; 6 adults; 7 nests (4 failed, 1 parasitized but fledged); fledged at least 3 2001: 1 territory; 2 adults; 2 nests (both failed); no fledglings 2002: 1 territory; 2 adults; 1 nest; fledged 3 2003: 2 territories; 3 adults; 3 nests (1 re-nest; 1 nest depredated and other failed) 2004: 1 territory; 2 adults; 2 nests (1 re-nest; both nests failed) 2005: 1 territory; 2 adults; 3 nests (all failed) 2006: 1 territory; 2 adults; 1 nest (failed) 2007: 1 territory; 2 adults; no nest				
Cookhouse	2002: (original detection) 1 adult (non-territorial) 2003-2006: surveyed, but no detections 2007: not surveyed	No	1	No	No
Grass Lake	1992-97: not surveyed 1998: (original detection) 3 territories; at least 5 adults; 2 nests (both failed); no fledglings 1999: 1 territory; 2 adults; 1 nest; fledged at least 1 2000: 1 territory; 2 adults; 2 nests (1 failed); fledged at least 1 2001: 1 territory; 2 adults; 2 nests (both failed); no fledglings 2002-07: surveyed, but no detections	No	5	No	No
Upper Truckee River (Airport)	2007: (original detection) 1 adult (non-territorial)	Yes	3	No	No
Trout Creek	1992-94: not surveyed 1995: surveyed, unconfirmed detection 1996-97: not surveyed 1998: surveyed, but no detections 1999-2001: not surveyed 2002: not surveyed; unconfirmed incidental detection 2003-07: surveyed, but no detections	No	1[b]	No	No
Edgewood Creek	2005: surveyed; unconfirmed detection of single bird	Possible	1[c]	No	No
Ski Run	2005: unconfirmed incidental detection of single bird	Possible	1[d]	Yes	Yes

[a] Rankings of 1 (lowest contribution to productivity) to 5 (highest contribution to productivity) were determined as follows: 1) habitat recently (2005-2007) unoccupied and historically occupied by singles only; 2) habitat recently unoccupied and historically occupied by pairs; 3) habitat recently occupied by singles; 4) habitat recently occupied by pairs; and 5) habitat recently or historically reproductive.

[b] Presence of willow flycatcher at Trout Creek (1995 and 2002), Edgewood Creek (2005), and Ski Run (2005) could not be confirmed immediately following the initial, potential detections. Habitat optimistically assigned a contribution to productivity value of one presuming the detections were of willow flycatchers. Otherwise (if the detections are false) these habitats would be assigned a value of zero (no contribution to productivity).

There are also currently or historically suitable habitats within the wildlife analysis area where surveys for willow flycatcher have been conducted, but where this species has not been detected (i.e., not recently or historically occupied). A summary of these survey areas, both project-related and coincidentally co-located historic (since 1992) within the wildlife analysis area, is presented in Table 3-107.

Table 3-107. Habitats surveyed for willow flycatcher within the wildlife analysis area since 1992 where detections of this species have not occurred (i.e., not recently or historically occupied)

Survey Area	Willow flycatcher Habitat Suitability	Treated in Alternative	
		2	3
Spring Creek	Marginal habitat (8.4 acres): small willow patch may have standing water in high water year; abundant edge and isolated conifers within willow patch increase the potential for predation or nest parasitism; adjacent neighborhood likely a substantial source of anthropogenic disturbance.	Yes	Yes
Saxon Creek	Marginal habitat: (11.0 and 13.2 acre riparian areas) small willow patch may have limited standing water in high water year; abundant edge and isolated conifers within willow patch increase the potential for predation or nest parasitism; adjacent neighborhood likely a substantial source of anthropogenic disturbance.	Yes	Yes
Angora Creek	Unsuitable habitat: (1.9 acres) undersized willows (burned in 2007 Angora Fire) may have had saturated soils in high water year; abundant edge and isolated conifers/snags within willow patch increase the potential for predation and nest parasitism; adjacent neighborhood likely a substantial source of anthropogenic disturbance.	No	No
Big Meadow	Marginally to moderately suitable habitat: (17.7 acres) soils saturated in high water years; recreation likely a substantial source of anthropogenic disturbance.	No	No
Big Meadow Creek	Marginal habitat: (11.8 acres) soils saturated in high water years; abundant edge and isolated conifers within willow patch increase the potential for predation and nest parasitism; located at high elevation (7,800 feet).	No	No
Meiss Lake	Moderately suitable habitat: (37.2 acres) at high elevation (8,400 feet).	No	No
High Meadows	Marginal habitat: (7.8 acres) soils regularly saturated by adjacent spring/seep; abundant edge and isolated conifers within small willow patch increase the potential for predation or nest parasitism; located at high elevation (7,800 feet).	No	No
Lake Christopher	Marginal habitat: (6.2 acres) small willows may have saturated soils in a high water year; abundant edge and isolated conifers within willow patch increase the potential for predation and nest parasitism; adjacent neighborhoods likely a substantial source of anthropogenic disturbance.	No	No
Heavenly Valley Creek	Marginal habitat: (19.3 acres) small willows may have saturated soils in high water year; abundant edge and isolated conifers within willow patch increase the potential for predation and nest parasitism; adjacent neighborhoods likely a substantial source of anthropogenic disturbance; conifer encroachment into some of the habitat reduced in 2007.	No	No

Willow Flycatcher Direct and Indirect Effects

Alternative 1

No thinning to reduce hazardous fuels, removal of excessive ground fuel, removal of conifer encroachment from meadows, or removal of conifer encroachment from aspen stands would be implemented to accomplish the project purpose and need. Existing conditions in the project area would continue to develop along their current trajectories. Conifers would continue encroaching suitable willow flycatcher habitat. Risk of wildland fire would continue to threaten willow flycatcher habitat, as demonstrated by the 2007 Angora Fire. Suitable willow flycatcher habitats would not be affected by this alternative. No direct or indirect effects would occur as a result of the No Action alternative.

Alternatives 2 and 3

Willow flycatchers are sensitive to disturbance and avoid highly disturbed wet meadow ecosystems that could otherwise provide suitable habitat. The potential of the action alternative to affect willow flycatcher is limited by the low coincidence of treatments with willow flycatcher habitats. Willow flycatchers are known to occur historically or currently within one location that would be treated in both Alternatives, Lily Lake (where this species was detected in 2002 and 2003). Treatment stands located adjacent to approximately one acre of suitable habitat on the western and southern shores of Lily Lake (lake estimated to be 8 acres in size) would be thinned. No changes in the seasonally saturated, deciduous riparian shrub willow flycatcher habitat are expected to occur, but effects to individuals during implementation could occur.

Thinning of an urban lot in the Ski Run Boulevard neighborhood, where an unconfirmed detection of a single willow flycatcher was reported in 2005, is not expected to affect this species as the habitat is unsuitable due intensive human disturbance. Implementation of either action alternative in suitable, but unoccupied habitats could affect willow flycatchers if the habitats became occupied during treatments. Project design features allow for protection of this species if it is discovered prior to or during implementation, minimizing the potential for direct effects. Limited Operating Periods in occupied or historically occupied suitable habitats (e.g., Lily Lake) would minimize the potential of project activities to affect this species during the nesting season and therefore minimize potential effects on reproduction. Outside of a LOP, effects may include equipment operation displacing individuals or changes in patterns of habitat use through avoidance of areas with ongoing project activities. Survival is unlikely to be affected as individuals of this species would be expected to avoid project activities.

The estimated number of acres of high and moderate capability willow flycatcher nesting, perching, and foraging habitat within the South Shore project area before and after implementation of Alternatives 2 and 3 are shown in Table 3-108. Total existing acres of these habitats within the wildlife analysis area are included for comparison. Alternatives 2 and 3 would not immediately increase or decrease the number of acres of suitable willow flycatcher habitat in the wildlife analysis area. However, the removal of encroaching conifers from marginally suitable meadow habitats (e.g., Spring Creek and Saxon Creek) may lead to the recruitment of deciduous riparian shrubs during the 15 years after implementation, which may improve the quality and suitability of these habitats for willow flycatchers. The potential of Alternative 3 to affect willow flycatchers or their habitat is expected to be slightly less than Alternative 2 because Alternative 3 would treat fewer acres (95 acres compared to 118 acres) of suitable habitats. Alternative 2 would treat approximately four percent and Alternative 3 would treat approximately three percent of suitable willow flycatcher habitats within the wildlife analysis area.

Table 3-108. Estimated acres of high and moderate capability willow flycatcher habitat within the project area before and after implementation of the action alternatives in comparison to the wildlife analysis area

	Habitat Capability	Nesting Habitat		Perching Habitat		Foraging Habitat	
		Before / After	Change	Before / After	Change	Before / After	Change
Alternative 2	High	115*	0	115	0	118	0
		115*		115		118	
	Moderate	0	0	3	0	0	0
		0		3		0	
	Total	115	0	118	0	118	0
		115		118		118	
Alternative 3	High	92*	0	92	0	95	0
		92*		92		95	
	Moderate	0	0	3	0	0	0
		0		3		0	
	Total	92	0	95	0	95	0
		92		95		95	
Wildlife Analysis Area	High	2,727		2,727		2,727	
	Moderate			78		78	
	Total	2,727		2,805		2,805	

* For clarity of display in the matrix above, figures for high capability nesting habitat represent both high and moderate capability nesting habitat as described in the existing conditions section for willow flycatcher.

Willow Flycatcher Cumulative Effects

Alternative 1

No direct or indirect effects would occur; therefore no cumulative effects would occur.

Alternative 2

The proposed action, when combined with past, present, and reasonably foreseeable future actions is not expected to have a cumulative effect to willow flycatcher because the risk of potential disturbance-type effects is low (i.e., four percent or less of suitable habitats would be treated and Limited Operating Periods in occupied or historically occupied habitats would minimize potential effects in treated areas) and because the quality and quantity of suitable habitats would not change immediately after implementation. Habitat quality may improve during the 15 years after project implementation if the removal of encroaching conifers encourages the recruitment of deciduous riparian shrubs that this species prefers. No cumulative effect to willow flycatcher habitat is expected because relatively few acres would be affected and increases in the quality and quantity of suitable habitat are likely to be minor and delayed in time.

Alternative 3

Cumulative effects for Alternative 3 are the same as those for Alternative 2 except that the scope of effects is slightly reduced as fewer acres would be treated (95 acres in Alternative 3 compared to 118 acres in Alternative 2).

Determination

Alternative 1 Determination: It is the determination of the Forest wildlife biologist that Alternative 1 of the South Shore project EIS will have **No Effect** on the Willow Flycatcher.

Alternative 2 and 3 Determination: It is the determination of the Forest wildlife biologist that Alternatives 2 and 3 of the South Shore project EIS may affect individuals, but are not likely to result in a trend toward federal listing or loss of viability for the Willow Flycatcher. rationale:

- Disturbance-type effects (e.g., equipment flushing an individual) are unlikely, but may occur during implementation
- Willow flycatcher habitat is not expected to increase or decrease in quality or quantity immediately after project implementation, but may increase during the 15 years after implementation if deciduous, riparian shrubs are recruited into treated areas
- Approximately three (Alternative 3) to four (Alternative 2) percent of suitable nesting, perching, and foraging habitats within the wildlife analysis area would be affected,

G. TRPA Special Interest Species

Scope of the Analysis, Indicators, and Issues

The Tahoe Regional Planning Agency (TRPA) Regional Plan created and adopted environmental threshold carrying capacities (“thresholds” or “threshold standards”) in two documents for fisheries and wildlife resources. These documents, the Goals and Policies (TRPA 1986) and the Code of Ordinances and Rules of Procedure (TRPA 1987), provide guidelines for threshold standards (TRPA 2002). Interagency collaboration between the US Forest Service and TRPA provided design features in Chapter 2 to address TRPA special interest species and their disturbance zones for the South Shore project. Information presented here is drawn from the South Shore project TRPA Report located in the project file and incorporated here by reference.

This section is divided into three parts. The first part describes the standards, indicators, and effects for fisheries. Terrestrial TRPA wildlife standards, indicators, and habitats of special significance are discussed next. Third is a discussion of effects for individual terrestrial special interest species.

Impact Analysis for Fisheries Threshold Standards and Indicators (F1-F4)

F-1 Lake Habitat

Standard: Achieve the equivalent of 5,948 total acres of excellent lake fish habitat.

Indicator: Physical disturbance of rocky (spawning and feed/cover habitats) substrate (acres).

The South Shore project has the potential to degrade fish habitat and substrate conditions. The potential for the project to degrade fish habitat will be mitigated by application of BMPs and design criteria found in Chapter 2 for system roads, new/existing temporary roads and new/existing landings. These BMPs and design criteria would conserve aquatic habitats in the project area. The potential for fine sediment to reach the lake is greater in Alternative 2 than Alternative 3 because Alternative 2 has more acres of mechanical treatment and uses more road miles. However, any increases in fine sediment would not be measurable under either of the action alternatives.

F-2 Stream Habitat

Standard: Maintain 75 miles of excellent, 105 miles of good, and 38 miles of marginal stream habitat as indicated by the Stream Habitat Quality Overlay map (1997).

Indicator: Miles of stream habitat in the various categories based on field investigations of habitat. A qualified fisheries biologist using empirical data should make determinations of stream quality.

The South Shore project has potential to impact stream habitat quality. The potential for the South Shore project to degrade fish habitat would be mitigated through application of BMPs and design criteria found in Chapter 2 for system roads, new/existing temporary roads and new/existing landings. These BMPs and design criteria would conserve aquatic habitats in the project area. Although reduction to stream shade may be detectable, any increases in stream temperature would not be measurable. Increases in fine sediment from project activities would also not be measurable. Current levels of in-channel LWD are not expected to decrease, and may increase where opportunities exist to place trees in streams to enhance fish habitat.

F-3 In-stream Flow

Standard: Until in-stream flow standards are established in the Regional Plan to protect fisheries values, a non-degradation standard shall apply to in-stream flows.

Indicator: In-stream flows evaluated by the use of an in-stream beneficial use assessment, such as the type established by Title 23, Section 670.6 of the California Administrative Code.

The South Shore project does not include new construction or maintenance of a water diversion, therefore there is no potential to affect in-stream flows.

F-4 Lahontan Cutthroat Trout[1]

Standard: It shall be the policy of the TRPA Governing Board to support, in response to justifiable evidence, state and federal efforts to reintroduce Lahontan cutthroat trout (LCT).

Indicator: (TRPA 1982a): Threshold would be achieved with the successful establishment of a Lahontan cutthroat trout population.

LCT are known to occur in the Upper Truckee River above Christmas Valley at the upper limit of the South Shore project area. This adjacent Lahontan cutthroat trout population could be affected by the project if individual LCT migrate into the project area before implementation occurs.

By decreasing the amount of combustible fuels within Upper Truckee River RCAs/SEZs the potential for future effects on LCT resulting from wildfire would decrease. Stream and watershed restoration efforts are also expected to occur in the Upper Truckee River as well as tributaries including Cold Creek, Angora Creek and Big Meadow Creek. Therefore, aquatic habitat quality for LCT (channel stability, pools, LWD and benthic productivity) is expected to increase over the long-term (> 5 years) as stream and watershed restoration efforts continue to move streams, wetlands and meadows toward desired conditions within the South Shore project area.

Terrestrial Wildlife Threshold Standards and Indicators (W-1, W-2)

W-1:Threshold Standard for Wildlife[2]

Standard: Provide a minimum number of population sites and disturbance zones for TRPA listed species.

Indicator: The minimum number of population sites and disturbance zones maintained as determined by inspection by qualified experts.

Table 3-109 (below) shows TRPA special interest species population site thresholds, disturbance zones, and whether potential exists for the project to impact the threshold standard within the Lake Tahoe Basin.

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[1]Although the 1991 and 1996 Threshold Evaluations (TRPA 1991 and 1996) acknowledged a threshold policy standard for the reintroduction of Lahontan cutthroat trout, the Governing Board did not adopt it as an official threshold standard. In the Threshold Evaluation (TRPA 2002), they recommended that the TRPA Governing Board adopt the F-4 Threshold Standard and Indicator (TRPA 2002).

[2] Under TRPA Code of Ordinances, Chapter 78-Wildlife Resources, the project biologist(s) must prepare appropriate documentation with specific recommendations for avoiding significant adverse impacts to the special interest, threatened, endangered or rare species (78.3.C).

Table 3-109. W-1 Standard Threshold for wildlife special interest species

Species	Population Sites[1]	Disturbance Zone (mi.)	Potential to Impact Threshold Standard? Y/N
Northern goshawk (*Accipter gentiles*)	12	0.50	Y
Osprey (*Pandion haliaetus*)	4	0.25	Y
Bald eagle (winter) (*Haliaeetus leucocephalus*)	2	Mapped	Y
Bald eagle (nesting)	1	0.50	N[2]
Golden eagle (*Aquila chrysaetos*)	4	0.25	N[3]
Peregrine falcon (*Falco peregrinus anatum*)	2	0.25	Y
Waterfowl	18	Mapped	Y
Mule deer (*Odocoileus hemionus*)	Critical fawning habitat	Critical fawning habitat is modeled	Y

[1]Based on the threshold evaluation by TRPA (2002), many of the population site goals have not been attained, and may never be realized for species like the golden eagle and peregrine falcon considering the Lake Tahoe basin has historically been considered suboptimal nesting habitat for both of these species. The northern goshawk threshold standard has a low likelihood of attainment by 2006 due to habitat fragmentation attributed to recreation encroachment nesting areas. The mule deer threshold is not likely to be realized due to recreational encroachment into meadows during fawning season (TRPA 2002). There would be a 'yes' for impacts to population sites only if impacting a known site. Threshold standards may not be attained basin-wide for certain populations, but that is an issue at the programmatic level, not at the project level.

[2] Proposed treatments are greater than 1 mile from the nearest bald eagle nest site; and are additionally over a ridge and around a prominent point along the shoreline from the nest site.

[3] Proposed treatments are greater than ¼ mile from golden eagle threshold nesting sites. Treatments are proposed adjacent to, but not within, one of two golden eagle disturbance zones within the project analysis area, at Angora Peak. Additionally no nesting activity has been recorded for golden eagle at this threshold site in at least the last 9 years according to the two most recent threshold evaluation reports (TRPA 2002, TRPA 2007). Hence the South Shore Fuels project will not affect the golden eagle disturbance zones or attainment of population thresholds.

Disturbance zones for osprey, peregrine falcon, bald and golden eagle, waterfowl, and mule deer would apply as described in TRPA Code of Ordinances, Chapter 78. Northern goshawk disturbance zones would include each known nest site unless the nest tree is no longer standing, as determined by site visits, or is located within an urban zone, as determined by TRPA Plan Area Statement maps. Limited operating periods (LOPs) for goshawks would only be applied when necessary, as determined by the USFS project biologist, within PACs rather than throughout TRPA disturbance zones (i.e., within a 0.5 mile radius of a goshawk nest). Vegetation treatment prescriptions within goshawk disturbance zones would be acceptable (i.e., meet the TRPA non-degradation standard) if they are consistent with prescriptions suitable for PACs. These collaboratively derived design features have been incorporated into Chapter 2 for the South Shore project.

W-2: Habitats of Special Significance

The Wildlife Threshold Standard W-2 states: A non-degradation standard shall apply to significant wildlife habitat consisting of deciduous trees, wetlands, and meadows while providing for opportunities to increase the acreage of such riparian associations.

The South Shore project proposes to reduce fuels hazardous fuels in SEZs within the WUI. Where consistent with fuel reduction objectives, thinning of encroaching conifers would occur in order to maintain/reclaim wetland and meadow landscapes. Fuel reduction along riparian corridors will maintain sufficient tree structure in order to supply future LWD recruitment to stream channels, maintain or increase stream shade characteristics, and potentially increase riparian vegetation as competition from conifers is reduced. Because non-degradation is the expected result, the South Shore project meets the W-2 Threshold Standard.

Individual TRPA Special Interest Species

In order to provide clear ties to the individual species that are TRPA special interest species, the existing conditions for wildlife habitats and the effects of the alternatives to those habitat conditions will be discussed specific to these individual special interest species.

Northern Goshawk

Existing Conditions

A total of 29 historic and current goshawk nesting trees occur within the project wildlife analysis area, as defined in the project biological evaluation in the project file. These nest trees form the basis for the 0.5 mile radius buffer TRPA goshawk disturbance zone for the South Shore project. TRPA Plan area statement (PAS) urban zones are not included. Habitat within this disturbance zone, totaling approximately 7,370 acres, is subject to TRPA non-degradation standards that would be met through the project design features from collaboration with TRPA. Because nests are often located close to each other as a group, the TRPA disturbance zone may be described as 10 separate disturbance zone areas, which, on a map, look like clusters of grapes, rather than 29 independent 0.5 mile radius circles. Nests within these disturbance zones are associated with goshawk territories (which may be considered population sites) and USFS protected activity centers (PACs). Existing Goshawk habitat conditions are further discussed in the terrestrial wildlife section of this chapter. Detailed descriptions of the existing conditions within each territory and/or PAC are also presented in the project biological evaluation located in the project file.

Direct, Indirect, and Cumulative Environmental Consequences

Alternative 1 (No Action)

With no vegetation treatments under this alternative, there would be no direct effects to northern goshawks or their habitat. Indirect effects of the No Action alternative would include continued accumulation of ground fuels and ladder fuel within goshawk habitats which would maintain or increase the risk of habitat loss from high intensity wildfire. Because wildfire is neither reasonably foreseeable nor quantifiable, no cumulative effects can be predicted for the No Action alternative.

Alternative 2 (Proposed Action) and Alternative 3

The South Shore project would treat approximately 1,924 acres (26%) in Alternative 2 or 1,623 acres (22%) in Alternative 3 of the 7,370 acres identified as goshawk disturbance zone within the wildlife analysis area. Treatments within the goshawk disturbance zone and PACs are designed to achieve the following criteria:

- at least two tree canopy layers;
- dominant and co-dominant trees with average diameters of 24 inches dbh;
- 60 to 70 percent canopy cover;

- an average of five to eight snags (five in eastside pine and mixed conifer, six in Westside pine and mixed conifer, and eight in red fir forest types) per acre larger than 20 inches dbh and of variable decay classes; and
- 15 tons of coarse woody debris (CWD) per acre larger than 20 inches in diameter (at the large end) and of variable decay classes.

Direct, indirect, and cumulative effects to goshawks and their habitat are discussed for each of the project alternatives in the Terrestrial Wildlife section of this chapter, with further details in the biological evaluation located in the project file. Effects to goshawk disturbance zones are discussed therein in context of post-fledging family areas (PFAs) of 500 acres, which are equivalent in scale to a disturbance zone (0.5 mile radius = 503 acres). A discussion of effects to goshawk population sites in terms of territories is contained in the biological evaluation located in the project file.

Summary and comparison of action alternative impacts to northern goshawk population sites and disturbance zones

The anticipated impacts of project implementation are generally characterized as adversely affecting individual goshawks and a portion of the suitable habitat in the wildlife analysis area during and immediately following project implementation, followed by benefits to goshawks and their habitat in the wildlife analysis area as stands mature during the 15-year period following implementation. Six of nine (67%) territories within the wildlife analysis area would be treated, at least in part, by either action alternative. There would be less risk to high quality territories in Alternative 3 because the Middle Saxon Creek and Lower Trout Creek B PACs and associated territories would not be treated. Survival and reproduction of goshawks within the wildlife analysis area would likely be greater for Alternative 3 than for Alternative 2 during and immediately following project implementation. The territories that would be treated in Alternative 2, but not in Alternative 3, would likely benefit from treatment approximately 15-years after implementation. The effects of Alternative 3 are expected to be more beneficial than Alternative 2. Six of 26 (23%) territories within the Lake Tahoe basin and less than one percent of goshawk territories in the Sierra Nevada would be affected.

Osprey

Existing Conditions

Recording of osprey nesting began in 1976. A total of 55 osprey historic or current nest trees are known within the South Shore project wildlife analysis area, primarily near the shores of Emerald Bay, Cascade Lake, Fallen Leaf Lake, and Lower Echo Lake. 25 of those nest trees have fallen or burned down in wildland fires, leaving 30 standing nest trees within the wildlife analysis area in 2008. The 30 standing osprey nest trees are each buffered by 0.25 mile to designate the 1,372 acre osprey disturbance zone. Osprey nests often occur in clusters as pairs may attempt nesting in multiple adjacent trees within and across years.

The average active nesting activity for the Lake Tahoe basin is that 54.5% of trees with nests have nesting activity in any given year (mean value for Lake Tahoe basin, 1997-2007, unpubl. data).Osprey actively nested in 10 (62.5%) of the 16 trees with nests in 2008, which is above average for the Lake Tahoe Basin. 10 juveniles fledged (mean=1.0 fledged/nest) within the wildlife analysis area in 2008, well above the average number of young fledged per nest (0.43 fledged/nest) for the Lake Tahoe Basin (Ibid). Osprey nesting activity in the wildlife analysis area is summarized below in Table 3-110.

Table 3-110. Osprey nesting activity in the wildlife analysis area, 2008 field season

Nest	Condition	Fledged	Nest	Condition	Fledged
CSL04	NG		EMB22	NP	
CSL06	NG		FLL04	A	
CSL07	A		FLL06	NG	
CSL08	NP		FLL09	NP	
EMB02	A		FLL14	NP	
EMB05	A	3	FLL15	NG	
EMB09	NG		FLL16	A	
EMB11	NG		FLL17	NP	
EMB14	A	2	RUP11	NG	
EMB15	NG		SLT02	A	3
EMB17	NP		SLT03	NG	
EMB18	NG		SLT04	NG	
EMB19	NG		SLT05	A	
EMB20	A		SLT06	A	2
EMB21	NP		SLT07	ND	

Nest Conditions: NG=nest gone; A=nest active; NP=nest present; and ND=nest dilapidated.

Direct, Indirect, and Cumulative Environmental Consequences

Alternative 1 (No Action)

There would be no vegetation treatments under this alternative; therefore, there would be no direct effects to osprey or their habitat. Indirect effects of Alternative 1 would include continued accumulation of ground fuels and ladder fuel within osprey habitats, which would maintain or increase the risk of habitat loss from high intensity wildfire. Because wildfire is neither quantifiable nor reasonably foreseeable, no cumulative effects can be predicted for the No Action Alternative.

Alternative 2 (Proposed Action) and Alternative 3

The South Shore project would treat approximately 370 acres (27%) in Alternative 2 or 350 acres (26%) in Alternative 3 of the 1,372 acres identified as osprey disturbance zones within the wildlife analysis area. Treatments within osprey disturbance zones would maintain suitable osprey habitat. Direct effects to habitat, especially within the disturbance zone, would be limited as trees would generally be thinned from below, retaining the larger, taller trees that osprey use. Suitable large trees within stands historically or currently used by osprey for perching or nesting would be identified and retained. All known, standing osprey nest trees within the treatment units would be retained. Future recruitment of large trees suitable for osprey perching and nesting would be provided in either action alternative by identifying and retaining an average of at least three suitable, large trees per acre in treatment stands located adjacent to Fallen Leaf Lake and Lower Echo Lake. Direct effects would also be mitigated by the rotation of treatment stands so that portions of suitable habitats would be available at all times (e.g., Fallen Leaf Lake would not be treated all at once or within a single year). Indirect effects to habitat would include increased health of trees retained following thinning, potentially increasing persistence of known nest trees and recruitment of future nest trees. No treatment stands are located adjacent to Emerald Bay or Cascade Lake; therefore, there would be no effect to those habitat areas from the South Shore project.

Direct effects to habitat, especially within the disturbance zone, would be limited as trees would generally be thinned from below, retaining the larger, taller trees that osprey use; nest trees would be retained, and future recruitment of nest trees would be addressed through retention of an average of three large trees per acre. Direct effects would also be mitigated by the rotation of treatment stands so that portions of suitable habitats would be available at all times. Indirect effects to habitat would include increased health of trees retained following thinning, potentially increasing persistence of known nest trees and recruitment of future nest trees. The cumulative effect to habitat (i.e., disturbance zones) of either action alternative would be to cause disturbance above background levels during implementation, but benefit the quality and quantity of habitats, especially in the shore zones of the Taylor Creek and Tallac Creek watersheds.

The likely direct effects to individual osprey during implementation would be disturbance-type effects (e.g., flushing an individual) rather than survival or reproduction-type effects (e.g., affecting adult or juvenile survival). Four nests are located within treatment stands and would have LOPs to protect nesting activity. Disturbance-type effects would likely end after implementation, though repeated treatments (i.e., thinning followed by pile burning) may be required in some stands.

Indirect effects to nesting, roosting, and foraging would be unlikely to occur as nesting and foraging take place from large trees and prey species are unlikely to be affected. In addition, design features would minimize the potential for user-created trails into recently-thinned stands to prevent additional recreational disturbance to osprey sites.

The cumulative effect to habitat (i.e., disturbance zones) of either action alternative would be to cause disturbance above background levels during implementation, but benefit the quality and quantity of habitats, especially in the shore zones of the Taylor Creek and Tallac Creek watersheds. Improved habitat conditions in the disturbance zone are expected following implementation compared to pre-treatment conditions in either action alternative which would benefit population sites, because tree density would be reduced and tree health improved for the lifetime of the treatments.

Bald Eagle

Existing Conditions

In 1987, TRPA designated a 2,473 acre bald eagle wintering habitat threshold area around Emerald Bay, Cascade Lake, Tallac Creek, and Taylor Creek. The TRPA bald eagle threshold is supported by the 1988 Forest LRMP (p.III-24). In 1994, the LTBMU evaluated potential bald eagle perch sites along the Lake Tahoe shore zone from Camp Richardson to Tallac Point; as a result, seven dominant trees were selected for pruning and tree retention for this species. Bald eagle habitat use surveys conducted in the Fallen Leaf Management Area in 1997 and 1998 further identified perch sites in the 1994 evaluation area, in Taylor Creek wetland, along Taylor Creek, and around Fallen Leaf Lake.

Direct, Indirect, and Cumulative Environmental Consequences

Alternative 1 (No Action)

There would be no direct effects to bald eagles or their habitat because there would be no vegetation treatments under this alternative. Indirect effects under Alternative 1 would include continued accumulation of ground fuels and ladder fuel within bald eagle habitats, which would maintain or increase the risk of habitat loss from high intensity wildfire. Because wildfire is neither quantifiable nor reasonably foreseeable, no cumulative effects can be predicted for the No Action alternative.

Alternative 2 (Proposed Action) and Alternative 3

The South Shore project would conduct vegetation treatments in up to ~165 acres within the TRPA bald eagle winter habitat mapped between Emerald Bay and Taylor Creek and in the Fallen

Leaf management area consistent with current management direction, the habitat evaluations completed in 1994, and the perch sites identified in 1997-8. These treatments within bald eagle winter habitat would maintain or improve habitat adjacent to wetland, wet meadow, and open water by resulting in: 1) late successional forest type, with an emphasis on Jeffrey pine-dominated stands; 2) retention of trees that are larger in diameter and taller than the dominant tree canopy, with an emphasis on trees greater than 40 inches diameter at breast height (dbh) and greater than 98 feet tall and on dead topped trees with robust, open branch structures; 3) an average of six snags per acre larger than 20 inches dbh and of variable decay classes.

Disturbance-type effects (e.g., individual bald eagles avoiding project equipment) may occur during implementation, but would likely end following implementation. Effects to reproduction are not expected because nest stands would not be treated. Both action alternatives would slightly increase the quality and quantity of bald eagle nesting, perching, and foraging habitats present in the wildlife analysis area. The action alternatives are consistent with the recovery plan for the Pacific bald eagle.

Peregrine Falcon

Existing Conditions

Two previously mapped population sites exist within the wildlife analysis area: Dardanelles and Luther Spires. Dardanelles is located over two miles from treatment stands for either action alternative and would not be affected, nor have peregrines been detected there in the last decade. This species has been detected at Luther Spires, Angora Peak, and South Maggie’s Peak. No nests have been found, though individuals appear to have been paired at least at the Luther Spires site. All sites are located on large, sheer cliff faces.

Direct, Indirect, and Cumulative Environmental Consequences

All Alternatives

There is no meaningful difference between alternatives in effects to Peregrine falcons or their habitat. Dardanelles, Angora Peak, and South Maggie’s Peak are located more than 0.25 mile (the disturbance zone for this species) from treatment units for either action alternative and would not be affected by project implementation. Luther Spires is located approximately 0.25 mile from proposed treatments. Direct impacts to peregrine habitat would not occur and direct impacts to individual peregrines are unlikely given the distance and superior position of the cliffs relative to the proposed treatments. Indirect impacts to peregrines may include slight changes in patterns of habitat use by prey species, subtly changing peregrine foraging behavior, though overall prey abundance is not expected to be affected by project implementation. No cumulative effects to peregrine population sites or habitat within disturbance zones are expected.

Waterfowl

Existing Conditions

Thirteen of 18 waterfowl threshold sites within the Lake Tahoe basin occur within the wildlife analysis area. There are two sites with treatment units: Taylor Creek and Baldwin Marsh. There are seven sites adjacent to treatment units: Pope Marsh, Lake Christopher, Osgood Swamp, Lower Echo Lake, Lake Baron, Grass Lake, and Fallen Leaf Lake. Four sites have no treatments in or nearby: Truckee Marsh, Edgewood Golf Course, Upper Echo Lake, and Fannette Island.

Direct, Indirect, and Cumulative Environmental Consequences

Alternative 1 (No Action)

Under the No Action alternative, disturbance-type effects to individual waterfowl would not occur in or adjacent to waterfowl threshold sites. Waterfowl habitat would not be improved and conifers would continue encroaching into meadows, particularly at Taylor and Tallac Marshes.

Alternative 2 (Proposed Action and Alternative 3)

The four waterfowl threshold sites without treatments in or near them would not be affected by project implementation. At the seven sites with treatments adjacent to them, disturbance-type effects (e.g., flushing waterfowl from nearby wetlands) would occur to individual waterfowl, but not to habitat, during implementation. Impacts are most likely to occur at Taylor Creek and Baldwin Marsh where treatments would occur in either action alternative. Direct effects at these sites would likely include disturbance to individual waterfowl and their upland habitats during implementation. Habitat modification would generally include the removal of encroaching conifers from meadows. The indirect effect of these habitat modifications would be to benefit waterfowl as acres of suitable habitat are increased and sightlines to predators are improved. Reasonably foreseeable future projects that may cause cumulative effects include the restoration of Taylor and Tallac Marshes, also to the benefit of waterfowl and their habitats in the project area. No negative cumulative effects to waterfowl or waterfowl threshold sites are expected as the result of the incremental impact of the action alternatives when added to other past, present, or reasonably foreseeable future actions because of the limited scope and expected impacts of the action alternatives.

Mule Deer

Existing Conditions

Mule deer in the wildlife analysis area generally belong to the Carson Herd and occur infrequently inside the Lake Tahoe basin. Mule deer generally occupy habitats in the wildlife analysis seasonally as snow pack permits. Seasonal habitat use includes fawning. An estimated 8,331 acres of mule deer fawning habitat exists in the wildlife analysis area, modeled by vegetation-type and proximity to perennial water sources. A major deer crossing is located at Highway 89 and the eastern end of Grass Lake, at the south-easternmost limit of treatment units under either action alternative.

Direct, Indirect, and Cumulative Environmental Consequences

Alternative 1 (No Action)

Disturbance-type effects to deer and their habitat would not occur under Alternative 1. Forested stands would continue to provide forage and cover for this species, although the risk of habitat loss from high intensity wildfire would continue to increase. Meadows and aspen stand habitat quality would not increase and herbaceous and deciduous tree cover would not change to benefit mule deer.

Alternative 2 (Proposed Action and Alternative 3)

Mule deer fawning habitat would be treated in both action alternatives. Alternative 2 would treat 1,740 acres (21%) of the estimated fawning habitat, while Alternative 3 would treat 1,689 acres (20%) of this habitat.

Disturbance-type effects (e.g., flushing individual deer or temporary changes in patterns of habitat use) would occur during implementation, except that deer are not generally in the area when over-snow operations take place. Project implementation in forested stands would adversely affect fawning habitat by reducing shrub and herbaceous cover and forage, but would increase sightlines to predators. These impacts would moderate over the lifetime of the treatments. Treatments in meadows and aspen stands would benefit fawning habitat by removing encroaching conifers, leading to increased herbaceous and deciduous cover and forage. Although more acres would be treated in forested stands, meadows are arguably more important to mule deer fawning. Treatment units would occur in the wildland urban interface (WUI), where manmade disturbance is common and this species rarely occurs; therefore, no cumulative effect to mule deer or their habitat is expected from implementation of either action alternative. The deer crossing at Highway 89 and Grass Lake would continue to function as a travel route for this species; disturbance would occur during implementation, but habitat fragmentation would not occur as adjacent, untreated habitats would provide temporary movement corridors.

H. Management Indicator Species

Scope of the Analysis, Indicators, and Issues

Management indicator species (MIS) are animal species identified in the Sierra Nevada Forest MIS Amendment Record of Decision 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). Effects are required to be addressed at two spatial scales: (1) at project scale, analyze the effects of proposed projects on the habitat of each MIS potentially affected by the projects, and (2) at the bioregional scale, monitor populations and/or habitat trends of MIS. Management indicator species for the LTBMU are identified in the 2007 Sierra Nevada Forests Management Indicator Species (SNF MIS) Amendment (USDA Forest Service 2007). Detailed information on the MIS is documented in the SNF Bioregional MIS Report (USDA Forest Service 2008), which is hereby incorporated by reference.

The South Shore project area is defined as the area where vegetation treatments would occur under the action alternatives. The South Shore project analysis area includes the project area and the associated seventh field hydrologic unit code (HUC7) watersheds. The South Shore project wildlife analysis area is spatially defined as the analysis area, plus the Echo Lake, California spotted owl PAC and home range core area (HRCA) and the Tahoe Regional Planning Agency bald eagle winter habitat mapped between Emerald Bay and Taylor Creek, California. The wildlife analysis area is temporally defined to extend 15 years before and after the present; in correlation with the estimated longevity of the majority of forest vegetation treatments.

Project-level effects to habitat are related to broader bioregional scale population and/or habitat trends. The approach for relating project-level impacts to broader scale trends is identified for MIS in the SNF MIS Amendment. Where distribution population monitoring for an MIS exists at the bioregional scale, the project-level habitat effects analysis for that MIS is informed by the distribution population monitoring data gathered at the bioregional scale. The bioregional scale monitoring for MIS analyzed for the South Shore project is summarized below.

Analysis of South Shore project effects to MIS involves the following steps:

1. Identify which habitats and associated MIS would be either directly or indirectly affected by project alternatives; these MIS are potentially affected by the project.
2. Analyze project-level effects on MIS habitat for this subset of MIS.
3. Summarize the bioregional-level monitoring for this subset of MIS.
4. Discuss bioregional scale habitat and/or population trends for this subset of MIS.
5. Relate project-level impacts on MIS habitat to habitat and/or population trends at the bioregional scale for this subset of MIS.

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 Forest Service 2007a), as listed in Table 3-111. These habitats are defined using the California wildlife habitat relationship (CWHR) system (CDFG 2005).

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 SNF bioregional MIS report (USDA Forest Service 2008).

MIS are classified into 3 categories for effects analysis. Category 1 MIS habitats are not in or adjacent to the project wildlife analysis area and would not be affected by the project. Category 2

MIS habitats are in or adjacent to project wildlife analysis area, but would not be directly or indirectly affected by the project. Category 3 MIS habitat has the potential to be either directly or indirectly affected by the project. There are thirteen MIS with the potential to be affected by activities in the South Shore project action alternatives. The MIS whose habitat would be either directly or indirectly affected by the South Shore project are analyzed to evaluate the direct, indirect, and cumulative effects of the proposed action and alternatives on the habitat of these MIS. The habitats, ecosystem components, and associated MIS analyzed for the South Shore project are listed in Table 3-111.

Table 3-111. MIS for project-level habitat analysis

Habitat or Ecosystem Component	CWHR Types defining the habitat or ecosystem component[1]	Sierra Nevada forests MIS
Riverine and Lacustrine	lacustrine (LAC) and riverine (RIV)	Aquatic macroinvertebrates
Riparian	montane riparian (MRI), valley foothill riparian (VRI)	yellow warbler (*Dendroica petechia*)
Wet meadow	Wet meadow (WTM), freshwater emergent wetland (FEW)	Pacific tree frog (*Pseudacris regilla*)
Early seral coniferous forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, and 3, all canopy closures	Mountain quail (*Oreortyx pictus*)
Mid-seral coniferous forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 4, all canopy closures	Mountain quail (*Oreortyx pictus*)
Late seral open canopy coniferous forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P	Sooty (blue) grouse (*Dendragapus obscurus*)
Late seral closed canopy coniferous forest	ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), tree size 5 (canopy closures M and D), and tree size 6.	California spotted owl (*Strix occidentalis occidentalis*)
		American marten (*Martes americana*)
		northern flying squirrel (*Glaucomys sabrinus*)
Snags in green forest	Medium and large snags in green forest	hairy woodpecker (*Picoides villosus*)
Snags in burned forest	Medium and large snags in burned forest (stand-replacing fire)	black-backed woodpecker (*Picoides arcticus*)

[1] All CWHR size classes and canopy closures are included unless otherwise specified.
tree size classes: 1 (seedling: <1" dbh); 2 (sapling: 1"-5.9" dbh); 3 (pole: 6"-10.9" dbh); 4 (small tree: 11"-23.9" dbh); 5 (medium/large tree: >24" dbh); 6 (multi-layered tree) [In PPN and SMC]
canopy closure classifications: S=Sparse cover (10-24% canopy closure); P= Open cover (25-39% canopy closure); M= Moderate cover (40-59% canopy closure); D= Dense cover (60-100% canopy closure); (Mayer and Laudenslayer 1988).

The habitat and/or population monitoring results described in the SNF bioregional MIS report (USDA Forest Service 2008) are summarized below for the MIS analyzed for the South Shore project.

Bioregional monitoring for aquatic macroinvertebrates: Index of Biological Integrity (IBI) and habitat condition and trend are measured by collecting aquatic macroinvertebrates, and analyzing the resulting data using the river Invertebrate Prediction and Classification System (RIVPACS) (Hawkins 2003) to determine whether the macroinvertebrate community has been impaired relative to reference condition within perennial water bodies. In addition, stream habitat features are measured according to the stream condition inventory (SCI) manual (Frasier et al. 2005).

Population monitoring at the bioregional scale for yellow warbler, Pacific tree frog, mountain quail, blue grouse, California spotted owl, American marten, northern flying squirrel, hairy woodpecker, and black-backed woodpecker is distribution population monitoring. Distribution population monitoring consists of collecting presence data for the MIS across a number of sample locations over time.

Existing Conditions and Effects of the Alternatives on the Habitat for the Selected Project-Level MIS

The following section discloses the project scale analysis for the following Category 3 species: aquatic macroinvertebrates, yellow warbler, Pacific tree frog, mountain quail, sooty (blue) grouse, California spotted owl, American marten, northern flying squirrel, hairy woodpecker, and black-backed woodpecker. For clarity and readability, the discussion is organized by MIS habitat with the discussion of indicator species included in each habitat. MIS habitat discussion begins with existing conditions, followed by direct and indirect effects of the alternatives, and ending with cumulative effects. The action alternatives are discussed together for ease of comparison and to reduce redundant text. A discussion of the relationship between project-level effects and bioregional status and trend is also included.

Lacustrine/Riverine Habitat (Aquatic Macroinvertebrates)

Habitat/species relationship

Aquatic or benthic macroinvertebrates (BMI) were selected as the MIS for riverine and lacustrine habitat in the Sierra Nevada. They have been demonstrated to be very useful as indicators of water quality and aquatic habitat condition (Resh and Price 1984; Karr et al. 1986; Hughes and Larsen 1987; Resh and Rosenberg 1989). They are sensitive to changes in water chemistry, temperature, and physical habitat.

Habitat factors for the analysis

Aquatic factors of particular importance are:

- Flow
- Sedimentation
- Water surface shade.

Existing Conditions

An estimated 225 miles of streams and 2,665 acres of lacustrine habitats exist within the wildlife analysis area.

Flow: Tributaries in the South Shore wildlife analysis area exhibit a snowmelt hydrograph intermixed with occasional rainfall events. The range of flows associated with a complete yield cycle correlate to the amount and type of precipitation. Other localized factors influencing base flows include ground water recharge zones (e.g., springs), solar input and upland/riparian vegetation. Urbanization and forest management (roads, grazing, fire suppression, etc.) have also influenced the duration and magnitude for flows from peak runoff to base flow. Channel incision has occurred from vegetative instability resulting in increased concentration of velocities (or stream power) where floodplains have been disconnected.

Sedimentation: Factors influencing sedimentation in the South Shore wildlife analysis area include channel condition (vertical and lateral stability), roads and associated road crossings, livestock grazing, urbanization and past wildfires. There are streams in the project area, which have undergone vertical and lateral adjustment (e.g., channel incision resulting from head-cutting) and currently exhibit bank erosion. Lower reaches of Angora Creek and Trout Creek exhibit positive attributes of channel stability (width/depth ratio, floodplain connectivity and density of riparian vegetation).

Water surface shade: Throughout the South Shore wildlife analysis area, the amount of stream shade is influenced by riparian shrubs, conifers, channel-spanning large woody debris, topographic features and channel morphology. Perennial streams with connected floodplains generally tend to have higher amounts of surface shade created by vegetation due to favorable growing conditions in the valley bottom. Since the 1930s the amount of stream shade generated by vegetation has been affected by land use practices (e.g., livestock grazing and logging). Contemporary levels of shade are influenced by current land uses (e.g., urbanization), geomorphology and ecological interactions (e.g., insect and disease outbreaks in adjacent conifer stands).

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Flow: No direct or indirect effects would occur from this alternative to flow within lacustrine/riverine habitats. Consequences of taking no action include continued conifer encroachment adjacent to streams and accretion of woody debris in and over stream channels, resulting in reduced flow and channel capacity, especially during periods of peak run-off, and increased potential for over-bank flows.

Sedimentation: No direct or indirect effects would occur from this alternative to sedimentation within lacustrine/riverine habitats. Consequences of taking no action include continued conifer encroachment adjacent to streams and accretion of woody debris in and over stream channels, resulting in alterations to stream geomorphology, including increased localized erosion and aggradation of sediments in low stream energy zones.

Water surface shade: No direct or indirect effects would occur from this alternative to water surface shade within lacustrine/riverine habitats. Consequences of taking no action include continued conifer encroachment adjacent to streams, accretion of woody debris in and over stream channels, and a loss of live streamside deciduous vegetation resulting in a net increase in stream shading.

Alternative 2 (Proposed Action) and Alternative 3

An estimated 21 miles of streams and 9 acres of lacustrine habitats are located within proposed treatment boundaries in Alternative 2. An estimated 20 miles of streams and 4 acres of lacustrine habitats are located within proposed treatment boundaries in Alternative 3.

Flow: By decreasing live conifer densities across the South Shore landscape, the duration of higher base flow conditions could potentially be extended into the late summer/fall months for both action alternatives. . However, under Alternative 3, the effect of higher base flow yield may be comparatively less because a number of mechanical treatment units were converted to hand thinning units under Alternative 3. The conversion to hand thinning units would decrease the amount of large tree removal, which typically uptake more available water. Soil compaction or displacement would not be expected to occur at levels resulting in a measurable increase in the magnitude of peak flows within most HUC7 watersheds under either action alternative. No negative effects are expected to natural ground water recharge zones (e.g., springs) that provide sources of flow to streams, because they would not be disturbed during implementation.

Sedimentation: The highest risk of sediment generation would result from mechanical treatments located in RCAs where reconstruction and/or construction of temporary roads and landings are needed to stage equipment and material. Under Alternative 2 there would be an average of 1.44% of temporary road density in RCAs, and Alternative 3 there would have an average of 1.59% of temporary road density in RCAs. Both action alternatives would result in 29 temporary road crossings throughout the project area. Alternatives 2 and 3 would decrease the potential for sediment delivery to streams by utilizing road BMPs designed to decrease the potential for sediment delivery to streams.

Most streams within the South Shore wildlife analysis area mobilize fine particle sizes by nature during various stages of discharge. These particle sizes are a product of local geology and channel geometric relationships (i.e. width, depth, and slope). Potential sediment generated from temporary roads and/or landings could result in a decrease of quality spawning sites for fish where small gravels occur, but would not be measurable under either action alternative due to implementation of road BMPs. The highest potential for sediment effects resulting from mechanical treatment in SEZs would occur in Trout Creek, Grass Lake Creek, Taylor Creek and Tallac Creek. The needed temporary road crossings would not be likely to produce sedimentation because they occur mostly over ephemeral tributaries and would be constructed and removed when ephemeral channels are dry.

Water surface shade: Immediate effects to stream shade and the future recruitment of LWD would result from fuels treatments within SEZs to achieve less than 150 ft2 basal area per acre. The potential for stream shade reduction as a result of fuel treatments would be less than that for Alternative 2 due to additional design criteria for stream buffers. Although stream shade within SEZs could be reduced over the short-term (< 5 years) it is expected that canopy structure and foliage would become more robust with the release of larger healthier trees, while riparian shrubs would increase in size and density as sunlight becomes more available under both action alternatives. It is not expected that there would be a measurable increase in stream temperatures as a result of mechanical and/or hand thinning activities in SEZs for either Alternative 2 or Alternative 3.

Cumulative Impacts

Alternative 1 (No Action)

There are no cumulative effects of the No Action alternative, because there are no direct or indirect effects of the No Action alternative. No changes to lacustrine/riverine habitats will occur as a result of the No Action alternative; therefore the No Action alternative will not alter the existing trend in the habitat.

The recent Angora Fire provides an example of the effects that could be expected under the no action alternative if wildfire occurs. The Angora Fire resulted in mostly high burn severities along the Angora Creek SEZ and affected stream shade, fine sediment input and local fish populations. Recent observations indicate that riparian vegetation is recovering; however, recovery potential is limited due to the incised condition of the channel. It is expected that future riparian/wetland restoration projects will increase the rate of recovery for aquatic habitat within the Angora Creek watershed.

Alternative 2 (Proposed Action) and Alternative 3

The potential for undesired channel adjustments resulting from increased peak flows in Taylor and Tallac Creeks would be reduced under Alternative 3 as compared to Alternative 2 due to a combination of .changes in fuel treatment methods and scheduling adjustments.

Past activities within the South Shore wildlife analysis area which have directly affected aquatic habitat include: stream restoration on Angora Creek and Trout Creek, wetland restoration on the Upper Truckee River, and erosion control measures for storm water runoff on state, county and municipal properties. Stream restoration projects have increased the quality of aquatic habitat in the South Shore wildlife analysis area. Erosion control projects have attempted to decrease the amount of fine sediment generated from developed lands. Urban lot fuel reduction on Forest Service and California Tahoe Conservancy lands has also occurred. Fuel management on urban lots has not created any measurable amounts of fine sediment input into streams. Larger, healthier trees are usually retained in the urban lots and have contributed to maintenance of stream shade where lots occur adjacent to perennial streams.

By decreasing the amount of combustible fuels within RCAs the potential for future effects on aquatic habitats resulting from wildfire would decrease within the South Shore project area under both action alternatives.

Stream and watershed restoration efforts that are not part of the South Shore project continue to move aquatic habitat toward desired conditions within the South Shore project area and contribute to positive cumulative effects. .Stream and watershed restoration efforts are also expected to occur in the Upper Truckee River, Cold Creek Angora Creek and Big Meadow Creek and increase aquatic habitat quality (channel stability, pools and LWD) over the long-term (> 5 years).

Alternative 3 would decrease the watershed level risks of potential peak flow adjustments as a result of fewer temporary roads compared to Alternative 2. Cumulative changes in flow resulting from South Shore project conifer removal may be measurable only where long-term stage recorders have been in place prior to implementation and recording data immediately adjacent to treatment units. However, changes in flow at most locations would not be measurable under either action alternative. The level of potential sedimentation would be dependant on precipitation events (during and after implementation) and the effectiveness of BMPs and design criteria. Although both alternatives propose fuel reduction in SEZs and decreases in stream shade would likely be detectable, any effects to stream temperature would not be measurable for either action alternative. The cumulative effect of the South Shore project fuel reduction together with continued stream restoration efforts would move degraded aquatic habitats toward desired conditions.

Summary of Aquatic Macroinvertebrate Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale index of biological integrity and habitat monitoring for aquatic macroinvertebrates; therefore, the lacustrine and riverine effects analysis for the South Shore project must be informed by these monitoring data. The information below is drawn from the detailed information on habitat and population trends in the Sierra Nevada forests bioregional MIS report (USDA Forest Service 2008).

Habitat and index of biological integrity status and trend

Aquatic habitat has been assessed using stream condition inventory (SCI) data collected since 1994 (Frasier et al. 2005) and habitat status information from the Sierra Nevada Ecosystem Project (SNEP) (Moyle and Randall 1996). Index of biological integrity is assessed using the river invertebrate prediction and classification system (RIVPACS) and macroinvertebrate data collected since 2000 (see USDA Forest Service 2008, Table BMI-1). These data indicate that the status and trend in the RIVPACS scores are stable.

Relationship of project-level habitat impacts to bioregional-scale aquatic macroinvertebrates habitat trend

Changes in flow, sedimentation, and water surface shading as a result of the proposed action are not likely to impact a substantial amount of existing riverine and lacustrine habitat within the Sierra Nevada. Therefore, the effects of the South Shore project will not alter the existing stable trend in the habitat for aquatic macroinvertebrates across the Sierra Nevada bioregion.

Riparian Habitat (Yellow warbler)

Habitat/species relationship

The yellow warbler was selected as the MIS for riparian habitat in the Sierra Nevada. This species is usually found in riparian deciduous habitats in summer (cottonwoods, willows, alders, and other small trees and shrubs typical of low, open-canopy riparian woodland) (CDFG 2005). Yellow warbler is dependent on both meadow and non-meadow riparian habitat in the Sierra Nevada (Siegel and DeSante 1999).

Habitat factors for the analysis

- Acres of riparian habitat (CWHR montane riparian (MRI) and valley foothill riparian (VRI)).
- Acres with changes in deciduous canopy cover (Sparse=10-24%; Open=25-39%; Moderate=40-59%; Dense=60-100%)
- Acres with changes in total canopy cover (Sparse=10-24%; Open=25-39%; Moderate=40-59%; Dense=60-100%)
- Acres with changes in CWHR size class [1/2 (Seedling/Sapling: <6" dbh); 3 (Pole: 6"-10.9" dbh); 4 (Small tree: 11"-23.9" dbh); and 5 (Medium/Large tree: >24" dbh)].

Existing Conditions

<u>Acres of riparian habitat</u>: A total of 3,658 acres of riparian habitat exists within the wildlife analysis area. Riparian habitat, as defined for this analysis, consists of deciduous riparian and mixed deciduous/coniferous riparian habitats. Nearly half (45%) of the riparian habitat within the wildlife analysis area consists of overly dense conifer encroached riparian habitat (e.g., mixed deciduous/coniferous).

<u>Deciduous canopy cover</u>: According to available riparian vegetation GIS data layers for the Lake Tahoe basin, riparian habitat dominated by deciduous canopy cover covers approximately 55% of riparian habitat within the wildlife analysis area; approximately 2,014 acres. This is likely an overestimate of current deciduous dominated riparian habitat within the wildlife analysis area, as the data used to generate the GIS layer is approximately 20 years old, and since this time fire suppression and lack of vegetation treatments in riparian areas have only further progressed conifer encroachment in riparian habitats in the Lake Tahoe basin. The only exception to this within the wildlife analysis area is within areas recently burned by wildfire (e.g., Angora Fire, Showers Fire, etc). Riparian habitat within recent fire area perimeters is generally dominated by deciduous canopy cover due to the removal of most encroaching conifers by the wildfire and rapid recovery of deciduous vegetation. However, outside of recent wildfire boundaries,

deciduous cover likely dominates the overstory of riparian habitat in < 55% of the wildlife analysis area.

Total canopy cover: Canopy cover in riparian habitats within the wildlife analysis area is predominately moderate; approximately 35% of riparian habitat contains canopy cover between 40-59%. Only 14 to 17% of the riparian habitat in the wildlife analysis area is in each of the remaining 3 canopy cover classes: sparse (10-24%), open (25-39%), and dense (60-100%). Approximately 17% of riparian habitat in the wildlife analysis area has a canopy cover of < 10%.

CWHR size class: Riparian habitat in the wildlife analysis area is dominated by size class 4 (11-24 in dbh); approximately 70% of riparian habitat is in this size class. Less than 2% of riparian habitat is in size class 5, 4% is in size class 3 and 24% of riparian habitat in the wildlife analysis area is smaller than size class 3.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Acres of riparian habitat: No riparian habitat would be treated under this alternative. No direct or indirect effects would occur from this alternative to acres of riparian habitat. Consequences of taking no action include continued conifer encroachment into riparian habitat, and possible eventual loss of some deciduous riparian habitat, especially aspen.

Acres of riparian habitat with changes in deciduous canopy cover: No direct or indirect effects would occur from this alternative to deciduous canopy cover within riparian habitat. Consequences of taking no action include continued conifer encroachment and concomitant declines in deciduous canopy cover over time.

Acres of riparian habitat with changes in total canopy cover: No direct or indirect effects would occur from this alternative to total canopy cover within riparian habitat. Consequences of taking no action include continued conversion of deciduous habitats to conifer habitat types.

Acres of riparian habitat with changes in CWHR size class: No direct or indirect effects would occur from this alternative to CWHR size classes within riparian habitat. Consequences of taking no action include continued conifer encroachment and increases in conifer CWHR size classes over time.

Alternative 2 (Proposed Action) and Alternative 3

Acres of riparian habitat: The number of acres of riparian habitat present would not be expected to increase or decrease due to implementation of Alternative 2 or Alternative 3. However, a total of 496 acres of riparian habitat would be affected, primarily enhanced, by Alternative 2, equivalent to approximately 14% of the riparian habitat present in the wildlife analysis area. By comparison, a total of 466 acres (approximately 13% of riparian habitat in the wildlife analysis area) would be affected and generally improved by Alternative 3. Direct and indirect effects to riparian habitat include a reduction in understory conifer cover in 496 acres of riparian habitat proposed for treatment under Alternative 2, and 466 acres in Alternative 3. All treatment prescriptions (hand or mechanical) would reduce understory conifer cover. Overstory conifer cover would be reduced on 240 acres (7% of riparian habitat) in Alternative 2 and 176 acres (5%) in Alternative 3 where mechanical treatments would occur. Treatments would be expected to improve the overall condition of riparian habitats in the project area by reducing competition from encroaching conifer to deciduous vegetation in both the understory and overstory.

Acres of riparian habitat with changes in deciduous canopy cover: Understory and overstory deciduous canopy cover would be expected to increase within riparian habitat treated under both action alternatives. These acres would be expected to show increases in understory deciduous canopy cover due to the reduction of understory conifer in all treatments. As indicated above, 240 acres in Alternative 2 and 176 acres in Alternative 3 may also show increases in overstory deciduous canopy cover due to mechanical treatments.

<u>Acres of riparian habitat with changes in total canopy cover</u>: Total overstory canopy cover in riparian habitats in the project area would be expected to change in areas proposed for mechanical treatments in riparian habitats. A reduction in total canopy cover by at least one size class due to conifer removal is expected on 240 acres (7%) of riparian habitat in Alternative 2, and 176 acres (5%) in Alternative 3. Reduction of conifer in the overstory canopy would be likely to show a short term reduction in total canopy cover of conifer, and a long term increase in total canopy cover of deciduous species.

<u>Acres of riparian habitat with changes in CWHR size class</u>: Both hand and mechanical treatments are designed to treat from the "bottom up", meaning that they emphasize removal of smaller tree size classes; therefore, size class distributions overall are expected to increase on the acres treated following implementation of either action alternative. Approximately 36% of the SEZ (including both riparian and meadow habitat) acres treated under Alternative 2 and 30% of SEZ acres treated in Alternative 3 would be expected to increase by at least one CWHR size class (e.g., 4 to 5) based on results of a pre-post treatment modeling effort. Changes to riparian habitat within the wildlife analysis area would be approximately 4%.

Cumulative Impacts

Alternative 1 (No Action)

There are no cumulative effects of the No Action alternative, because there are no direct or indirect effects of the No Action alternative.

No changes to riparian habitats will occur as a result of the No Action alternative; therefore the No Action alternative will not alter the existing trend in the habitat.

Alternative 2 (Proposed Action) and Alternative 3

A complete listing of past, present, and reasonably foreseeable future actions affecting all special status species habitats, including MIS habitat, as well as a description of the cumulative effects analysis area boundary is provided in the project BE/BA in the project file. Projects affecting MIS riparian habitat include: engineering projects for which trails/roads or other infrastructure overlapping SEZs and riparian habitat were constructed, decommissioned or re-routed out of the SEZ; stream restoration projects in which floodplains were reconnected to the stream or streamside revegetation occurred; and vegetation management projects in which treatments were conducted at least partially in riparian habitat. Impacts of these projects, in addition to either of the action alternatives of the South Shore project, are positive overall for riparian habitats. Impacts of relevant engineering projects on riparian habitat include: reduced human disturbance to riparian areas through re-routing and decommissioning roads and trails away from riparian areas, and increased area of functional riparian habitat by decommissioning roads and trails in riparian habitat. Impacts of stream restoration projects include increased riparian deciduous vegetation cover and structure primarily due to increased stream-floodplain connectivity which increases streamside water availability. In some cases, direct planting of riparian vegetation increased riparian deciduous vegetation cover and structure. Lastly, effects of vegetation management projects, including both action alternatives, in riparian habitats primarily involve the direct removal of encroaching conifer and downed wood from riparian areas. This generally reduces total canopy cover, increases light availability to the understory, and indirectly enhances both the deciduous canopy cover and herbaceous ground cover. In summary, the cumulative impacts of all past, present, and reasonably foreseeable future projects in the wildlife analysis area combined with either Alternative 2 or Alternative 3 are: approximately 10 acres of riparian habitat with reduced disturbance due to engineering projects, ~100 acres riparian habitat restored or otherwise enhanced by stream restoration projects. Increased deciduous and herbaceous cover resulting from vegetation treatments in the project wildlife analysis area would be expected on~750 acres for Alternative 2 and ~720 acres for Alternative 3..

There are approximately 29,000 acres of riparian habitat throughout the Sierra Nevada bioregion. The cumulative effects to riparian habitat as a result of all past, present and reasonably foreseeable future projects combined with Alternative 2 would provide enhancement of ~860 acres (~3%) of riparian habitat throughout the Sierra Nevada bioregion. Of the 860 acres of habitat enhancement within the wildlife analysis area, Alternative 2 contributes 496 acres (58%). The cumulative effects to riparian habitat as a result of all past, present and reasonably foreseeable future projects combined with Alternative 3 would provide enhancement of ~830 acres (~2.8%) of riparian habitat throughout the Sierra Nevada bioregion. Of the 830 acres of habitat enhancement within the wildlife analysis area, Alternative 3 contributes 466 acres (56%). The cumulative enhancement of either action alternative to riparian habitat in the Sierra Nevada bioregion will not alter the existing trend in riparian habitat.

Summary of Yellow Warbler Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the yellow warbler; hence, the riparian habitat effects analysis for the South Shore 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 yellow warbler. This information is drawn from the detailed information on habitat and population trends in the SNF Bioregional MIS Report (USDA Forest Service 2008).

Habitat status and trend

There are currently 29,000 acres of riparian habitat on National Forest System lands in the Sierra Nevada. Within the last decade, the trend is stable.

Population status and trend

The yellow warbler has been monitored in the Sierra Nevada at various sample locations by avian point counts and breeding bird survey protocols, including Lassen NF (Burnett and Humple 2003, Burnett et al. 2005) and Inyo NF (Heath and Ballard 2003) point counts; on-going California Partners in Flight monitoring and studies (CPIF 2004); 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 yellow warblers continue to be present at these sample sites, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of yellow warbler populations in the Sierra Nevada is stable.

Relationship of project-level habitat impacts to bioregional-scale yellow warbler trend

The change in deciduous canopy closure of 466-496 acres, the change in total canopy cover of 176-240 acres, and the change in CWHR size class of 140-179 acres (for alternatives 3 and 2, respectively) out of a total of 3,658 acres of riparian habitat in the wildlife analysis area, and 29,000 acres 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 yellow warblers across the Sierra Nevada bioregion.

Wet Meadow Habitat (Pacific tree frog)

Habitat/species relationship

The Pacific tree frog was selected as an MIS for wet meadow habitat in the Sierra Nevada. This broadly distributed species requires standing water for breeding; tadpoles require standing water for periods long enough to complete aquatic development, which can be as long as three or more months at high elevations in the Sierra Nevada (CDFG 2005). During the day during the breeding season, adults take cover under clumps of vegetation and surface objects near water; during the remainder of the year, they leave their breeding sites and seek cover in moist niches in buildings, wells, rotting logs or burrows (Ibid).

Habitat factors for the project-level effects analysis

- Acres of wet meadow habitat [CWHR wet meadow (WTM) and freshwater emergent wetland (FEW)].
- Acres with changes in CWHR herbaceous height classes [short herb (<12”), tall herb (>12”)].
- Acres with changes in CWHR herbaceous ground cover classes (Sparse=2-9%; Open=10-39%; Moderate=40-59%; Dense=60-100%).
- Changes in meadow hydrology.

Existing Conditions

Acres of wet meadow habitat: There are an estimated 1,283 acres of wet meadow habitats located within the wildlife analysis area. Wet meadow habitats are generally found in shore zone marshes (Taylor-Tallac and Upper Truckee complexes), at Washoe Meadows and Osgood Swamp, and along Trout Creek, Angora Creek, Saxon Creek, and the Upper Truckee River.

Acres with changes in CWHR herbaceous height classes: As data regarding changes in herbaceous height classes are not available, this analysis will discuss this habitat factor qualitatively and in general quantitative terms (i.e., increases and decreases). The wet meadow habitats (1,283 acres) in the wildlife analysis area are composed of a heterogeneous distribution of tall and short herb height classes.

Acres with changes in CWHR herbaceous ground cover classes: As data regarding changes in herbaceous height classes are not available, this analysis will discuss this habitat factor qualitatively and in general quantitative terms (i.e., increases and decreases). The wet meadow habitats (1,283 acres) in the wildlife analysis area are composed of a heterogeneous distribution of tall and short herb cover classes.

Changes in meadow hydrology: Wet meadows systems along the fringes of Lake Tahoe shore zones were historically influenced by lake level and channel function. Meadows in the shore zone interface have undergone modifications due to dredging of the Tahoe Keys, road building, community development (housing, creation of public utility systems, etc.) and channelization. Stream restoration has occurred in Washoe Meadows and Trout Creek and restored wet meadow function. Other modifications have occurred to associated meadow channels in Upper Truckee River and Saxon and Angora Creeks, which have converted meadows to drier sites and made them susceptible to conifer encroachment.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Acres of wet meadow habitat: No wet meadow habitat would be treated under this alternative. No direct or indirect effects would occur from this alternative to acres of wet meadow habitat. Consequences of taking no action include continued conifer encroachment and reduced available subsurface water.

Acres with changes in CWHR herbaceous height classes: No direct or indirect effects would occur from this alternative to herbaceous vegetation within wet meadow habitats.

Acres with changes in CWHR herbaceous ground cover classes: No direct or indirect effects would occur from this alternative to herbaceous vegetation within wet meadow habitats.

Changes in meadow hydrology: No direct or indirect effects would occur from this alternative to meadow hydrology within wet meadow habitats.

Alternative 2 (Proposed Action) and Alternative 3

Acres of wet meadow habitat: One of the objectives of the South Shore project is to remove encroaching conifers from the edges of meadow landscapes consistent with fuel reduction goals. As displayed in Table 3-116, Alternative 2 would increase the amount of wet meadow landscapes by approximately 115 acres, and Alternative 3 would increase the amount of wet meadow landscapes by approximately 99 acres. Removal of encroaching conifers along meadow margins would be expected to increase the amount of available water throughout these landscapes, except where channels are incised and water tables are below their natural levels.

Acres with changes in CWHR herbaceous height classes: The distribution of tall and short herb height classes in wet meadows would be affected by changes in local water tables caused by the vegetation removal in both Alternative 2 and Alternative 3. Species adapted to drier conditions would move slightly upslope and those adapted to wetter soil conditions would colonize or expand into lower areas. Ground cover suitable for Pacific tree frog in wet meadows would be expected to increase shortly after implementation and likely persist for the duration of the longevity of the treatments (15-20 years).

Acres with changes in CWHR herbaceous ground cover classes: Herbaceous ground cover in wet meadows would increase as encroaching conifers are removed. Increased ground cover would increase soil moisture retention and improve habitat quality for this species.

Changes in meadow hydrology: Increases in herbaceous ground cover and reductions in soil water uptake by conifers after thinning would increase available subsurface water and the duration of or potential for soil saturation. The magnitude of changes to meadow hydrology would likely be minimal and difficult to measure due to the scale of the change anticipated and the limited amount of pre-implementation data available.

Cumulative Impacts

Alternative 1 (No Action)

There are no cumulative effects of the No Action alternative, because there are no direct or indirect effects of the No Action alternative.

No changes to wet meadow habitats will occur as a result of the No Action alternative; therefore the No Action alternative will not alter the existing trend in the habitat.

Alternative 2 (Proposed Action)

Channel restoration and vegetation prescriptions occurring in the South Shore wildlife analysis area would result in reclaiming the amount of wet meadow area, as well as improving how these systems function hydrologically. Since the late 1990s stream restoration has occurred in Trout Creek and Angora Creek. These channel restoration projects have indirectly increased water availability in associated meadow systems, making them more self-sustaining. Future stream restoration in associated meadows systems is anticipated to occur in the Upper Truckee River, Cold Creek and Angora Creek. The Big Meadow restoration project is anticipated to be implemented in the next three years and will involve hand thinning and prescribed fire treatments in and along the margins of Big Meadow. Channel restoration and vegetation prescriptions occurring in the South Shore wildlife analysis area would result in reclaiming the amount of wet meadow area, as well as how these systems function hydrologically. Currently, no past or current vegetation management projects with objectives of reclaiming meadow landscapes from encroaching conifers have been implemented. The cumulative impacts of all past, present, and reasonably foreseeable future projects in the wildlife analysis area combined with either Alternative 2 or Alternative 3 of the South Shore project are expected increase the quality and quantity of available wet meadow habitat.

66,000 acres of wet meadow habitats currently exist on National Forest System lands in the Sierra Nevada Mountains. The cumulative effect to wet meadow habitats from all past, present and reasonably foreseeable future projects in the wildlife analysis area plus either action alternative is to increase the acreage of wet meadows by less than a thousand acres. The contribution of Alternative 2 is 115 acres of wet meadow habitat, while the contribution of Alternative 3 is 99 acres. The addition of either 99 or 115 acres of wet meadow habitat due, combined with all past, present and reasonably foreseeable future projects in the wildlife analysis area, will not alter the existing trend in this habitat.

Summary of Pacific Tree Frog Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the Pacific tree frog; hence, the wet meadow effects analysis for the South Shore 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 Pacific tree frog. This information is drawn from the detailed information on habitat and population trends in the SNF Bioregional MIS Report (USDA Forest Service 2008).

Habitat status and trend

There are currently 66,000 acres of wet meadow habitat on National Forest System lands in the Sierra Nevada. Within the last decade, the trend is stable.

Population status and trend

Since 2002, the Pacific tree frog has been monitored on the Sierra Nevada forests as part of the Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan (USDA Forest Service 2006, 2007b; Brown 2008). These data indicate that Pacific tree frog continues to be present at these sample sites, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of Pacific tree frog populations in the Sierra Nevada is stable.

Relationship of project-level habitat impacts to bioregional-scale Pacific tree frog

Trend changes in wet meadow habitat as a result of the proposed action, while positive and potentially beneficial to Pacific tree frog at the scale of the project and probably the Lake Tahoe basin (potentially creating a range of 99 - 115 acres of wet meadow habitat), are not likely to impact a substantial amount of existing wet meadow habitat within the Sierra Nevada. Therefore, the effects of the South Shore Reduction Project will not alter the existing stable trend in the habitat for Pacific tree frog across the Sierra Nevada bioregion.

Early and mid-seral Coniferous Forest Habitat (Mountain quail)

Habitat/species relationship

The mountain quail was selected as the MIS for early and mid-seral coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat in the Sierra Nevada. Early seral coniferous forest habitat is comprised primarily of seedlings (<1" dbh), saplings (1"-5.9" dbh), and pole-sized trees (6"-10.9" dbh). Mid-seral coniferous forest habitat is comprised primarily of small-sized trees (11"-23.9" dbh). The mountain quail is found particularly on steep slopes, in open, brushy stands of conifer and deciduous forest and woodland, and chaparral; it may gather at water sources in the summer, and broods are seldom found more that 0.8 km (0.5 mi) from water (CDFG 2005).

Habitat Factors for the Project-level Effects Analysis

- Acres of early (CWHR tree sizes 1, 2, and 3) and mid-seral (CWHR tree size 4) coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat [CWHR ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree sizes 1, 2, 3, and 4, all canopy closures].
- Acres with changes in CWHR tree size class.
- Acres with changes in tree canopy closure.
- Acres with changes in understory shrub canopy closure.

Existing Conditions

<u>Acres of early and mid-seral coniferous forest</u>: A total of 24,157 acres of early and mid-seral coniferous forest (as defined above) currently occur in the South Shore wildlife analysis area.

<u>CWHR tree size class</u>: Currently, only 1% of the total acres of early and mid-seral coniferous forest in the wildlife analysis area is in early seral condition, CWHR size classes 1, 2 or 3 (< 11" dbh), while 99% is in mid-seral condition, size class 4 (11-23.9" dbh).

<u>Tree canopy closure</u>: Overstory tree canopy closure in early and mid-seral coniferous forest in the wildlife analysis area is predominantly in the moderate (40-59% cover) and open (25-39% cover) canopy cover classes; 43 and 34% of early and mid-seral conifer forest respectively. Only 5% and 18% of early and mid-seral coniferous forest is characterized by either dense (60-100% cover) and sparse (10-24%) canopy cover, respectively.

<u>Understory shrub canopy closure</u>: Data for this habitat factor were not collected for every stand planned for treatment under the South Shore project, however, an existing dataset from the multi species inventory and monitoring (MSIM) project provided some on the ground data at 61 locations within early and mid-seral coniferous forest throughout the South Shore wildlife analysis area. Vegetation data from the MSIM project, including understory shrub cover, were collected in 2002-2005. Shrub cover estimates at these 61 stations varied from 0% cover to as much as 70% shrub cover, with an average of 12% shrub cover.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Acres of early and mid-seral coniferous forest: No acres of early and mid-seral coniferous forest would be affected by the No Action alternative, because no treatments would be implemented as a result of this alternative.

Acres with changes in CWHR tree size class: The No Action alternative would result in no changes in CWHR tree size classes, because no treatments would be implemented as a result of this alternative.

Acres with changes in tree canopy closure: The No Action alternative would result in no changes in tree canopy closure, because no treatments would be implemented as a result of this alternative.

Acres with changes in understory shrub canopy closure: The No Action alternative would result in no changes in understory shrub canopy closure, because no treatments would be implemented as a result of this alternative.

Alternative 2 (Proposed Action) and Alternative 3

Acres of early and mid-seral coniferous forest: Vegetation thinning treatments of early and mid-seral coniferous forest would take place on a total of 3,591 acres under Alternative 2 and 3,457 acres under Alternative 3. Under Alternative 2, a net loss of 600 acres of early and mid-seral coniferous forest (size classes 1-4) would result, and Under Alternative 3 the net loss would be 467 acres. Late seral open coniferous forest (size class 5) would result on 442 acres in Alternative 2 and 314 acres in Alternative 3. Alternative 2 would convert 158 acres to late seral closed coniferous forest, and 153 acres would be converted to late seral closed coniferous forest structure in Alternative 3. This type conversion of early and mid-seral coniferous forest represents 2.5% of all early and mid-seral coniferous forest in the wildlife analysis area for Alternative 2 and 2% for Alternative 3.

Acres with changes in CWHR tree size class: Because most treatments proposed under both action alternatives would focus on removal of understory, small diameter trees, and retention of larger trees within the stand, treatments are expected overall to result in an increase in the average tree diameter per stand, and a decrease in both understory tree cover and overall vertical vegetation structure. A total of 600 acres of early and mid-seral coniferous forest would be expected to change CWHR tree size class as a result of Alternative 2, primarily from size class 4 to size class 5. This area represents 2.5% of all early and mid-seral coniferous forest in the wildlife analysis area. A total of 467 acres of early and mid-seral coniferous forest would be expected to change CWHR tree size class as a result of Alternative 3, primarily from size class 4 to size class 5, representing 2% of all early and mid-seral coniferous forest in the wildlife analysis area

Acres with changes in tree canopy closure: Thinning treatments would be expected to reduce total canopy closure by removal of the smallest diameter trees within the canopy, and thereby reduce competition for resources for trees retained in the canopy after treatments. While canopy closure would be reduced within these acres immediately post project, total canopy closure of the remaining large trees would be expected to increase over the long term. Treatments under Alternative 2 would result in reduction in tree canopy closure by at least one canopy cover class within 1,728 acres (7%) of early and mid-seral coniferous forest, while Alternative 3 would result in reduction in tree canopy closure by at least one canopy cover class within 1,538 acres (6%) of early and mid-seral coniferous forest within the wildlife analysis area.

Acres with changes in understory shrub canopy closure: Acres with changes in understory shrub canopy closure were determined by: 1) determining the number of acres of early and mid-seral coniferous forest proposed for each unique treatment prescription combination under each action alternative, then 2) estimating the percentage of area for which ground disturbance, and hence potential impacts to shrub cover, was anticipated for each unique treatment prescription. Estimates were generated by the project forester and were based on past experience. Total acres of early and mid-seral coniferous forest proposed for treatments, anticipated percentage of acres affected by each treatment combination and the resultant estimate of acres with changes in understory shrub cover as a result of Alternatives 2 and 3 are summarized in Tables 3-112 and 3-113 below. Two primary and follow-up prescription combinations would be expected to result in no effects to understory shrub cover: hand thinning followed by either landing pile burning or removal by hand. All other treatments vary in the percentage of area with anticipated effects to understory shrub cover.

Understory shrub canopy cover would change on an estimated 689 acres in Alternative 2, representing 3% of all early and mid-seral coniferous forest in the wildlife analysis area (Table 3-112). Understory shrub canopy cover would change on 631 acres in Alternative 3, representing 2.5% of early and mid-seral coniferous forest in the wildlife analysis area.

Direct and indirect effects under Alternatives 2 and 3 to understory shrub canopy closure are primarily a short term reduction in total shrub cover due to one or several of the following possible actions: 1) the physical disturbance of shrubs from equipment use during mechanical thinning operations, 2) removal of shrubs within areas to be used for landings, 3) the purposeful burning of shrubs, as occurs in underburning treatments, or 4) incidental burning of shrubs, as occurs in pile burning treatments. Shrub cover reduction resulting from vegetation treatments would be expected to recover within 3-10 years after treatment implementation. The timeframe for regrowth would be dependent upon the dominant shrub species, treatment type, and site conditions.

Tables 3-112 and 3-113 below show effects on understory shrub cover from primary and secondary follow up treatments occurring within early and mid-seral coniferous forest under Alternatives 2 and 3. Effects of each treatment combination to understory shrub cover are represented as a percentage of treatment acres within which ground disturbance is estimated to occur, to estimate effects to shrub cover. Acres with changes in understory shrub cover were calculated based on the estimated percentage impact described above and total treatment acres proposed for each action alternative.

Table 3-112. Alternative 2 7reatments and effects to understory shrub cover

Primary Thinning Treatment	Follow up Fuels Treatment	Treatment acres in early mid-seral coniferous forest	Combined treatment effects to understory shrub cover (% area affected)	Acres with changes in understory shrub canopy cover
Cut-to-length	Chipping/mastication	318	70	223
	Whole tree forwarding	0	15	0
Whole tree removal	Landing pile burning	822	20	164
	Landing pile burning; underburning	103	70	72
	Lop and scatter	0	20	0
	Lop and scatter; underburning	0	70	0
Hand thin	Chipping/mastication	1	70	~1
	Hand pile and burn	2,204	6	132
	Chipping/mastication; underburning	0	70	0
	Chipping/mastication; hand pile and burn	139	70	97
	Landing pile burning*	4	0	0
	Removal by hand	0	0	0

*Impacts associated with creation of landings for pile burning operations accounted for in the primary thinning treatment categories.

Table 3-113. Alternative 3 treatments and effects to understory shrub cover

Primary thinning treatment	Follow up fuels treatment	Treatment acres in early mid-seral coniferous forest	Treatment effects to understory shrub cover (% area affected)	Acres with changes in understory shrub canopy cover
Cut-to-length	Chipping/mastication	370	70	259
	Whole tree forwarding	0	15	0
Whole tree removal	Landing pile burning	196	20	39
	Landing pile burning; Underburning	14	70	10
	Lop and scatter	0	20	0
	Lop and scatter; Underburning	0	70	0
Hand thin	Chipping/mastication	1	70	1
	Hand pile and burn	2,644	6	159
	Chipping/mastication; Underburning	147	70	103
	Chipping/Mastication; Hand pile and burn	85	70	60
	Landing pile burning*	0	0	0
	Removal by hand	0	0	0

*Impacts associated with creation of landings for pile burning operations accounted for in the primary thinning treatment categories.

Cumulative Impacts

Alternative 1 (No Action)

There are no cumulative effects of the No Action alternative to early and mid-seral coniferous forest habitat because there would be no direct or indirect effects of this alternative.

Due to the lack of direct, indirect and cumulative effects, the No Action alternative would not alter the existing trend in early and mid-seral coniferous forest.

Alternative 2 (Proposed Action) and Alternative 3

A complete listing of past, present, and reasonably foreseeable future actions affecting MIS and special status species habitats as well as a description of the cumulative effects in the wildlife analysis area is provided in the project BE/BA in the project file. Projects affecting early and mid-seral coniferous forest habitat include primarily vegetation management projects, but also include a few engineering and stream restoration projects in which small areas of early and mid-seral forest were or are planned to be disturbed or removed in order to meet the objectives of the project. Impacts of vegetation management projects within the wildlife analysis area to early and mid-seral coniferous forest are similar to impacts described above for the action alternatives of the South Shore project, and include: an increase in average tree size class of stands due to removal of smaller trees and retention of the largest trees within stands, reduction in total canopy cover (primarily that of the mid- and under-story components), and a short term reduction in understory shrub cover. Impacts of vegetation management actions described in some cases lead to a reduction in the overall extent of early and mid-seral coniferous forest across the landscape in favor of stands expected to develop into late seral coniferous forest. Impacts of engineering and stream restoration projects on early and mid-seral coniferous forest primarily include the loss of small amounts of early and mid-seral forest due to trail or stream re-routes into higher capability land types requiring the loss of trees along the corridor or path of the re-route.

Estimates of acres with changes to habitat factors and acres of habitat converted to other forest types throughout the wildlife analysis area were based on the percentage of treated acres in the South Shore project area that were anticipated to result in similar impacts to early and mid-seral habitat. For Alternative 2, 16.7% of treated acres are anticipated to be converted to late seral condition and 48% are anticipated to have changes to habitat factors. For Alternative 3, 13.5% of treated acres are anticipated to be converted to late seral condition and 44% are anticipated to have changes to habitat factors. In total, an estimated 1,060 acres of early and mid-seral forest was or would be converted to other forest types due to vegetation treatments when combined with Alternative 2 of the South Shore project, and an estimated 840 acres would be converted to other forest types due to vegetation treatments when combined with Alternative 3. Also, approximately 12 acres were or would be lost due to engineering and stream restoration projects throughout the wildlife analysis area. In addition, approximately 3,050 acres of early and mid-seral habitat are estimated to result in changes to habitat factors as a result of vegetation treatments associated with vegetation and restoration projects for Alternative 2 and approximately 2,750 acres for Alternative 3. In summary, the cumulative impacts of all past, present, and reasonably foreseeable future projects affecting early and mid-seral coniferous forest in the wildlife analysis area when combined with Alternative 2 include: loss or type conversion of up to ~1,072 acres of early and mid-seral coniferous forest to late seral conditions, and a change in tree size class, canopy cover class and understory shrub cover to ~3,050 acres. For Alternative 3 the cumulative impacts of all past, present, and reasonably foreseeable future projects affecting early and mid-seral coniferous forest in the wildlife analysis area when combined with Alternative 3 include: loss or type conversion of up to ~852 acres of early and mid-seral coniferous forest to late seral conditions, and change in tree size class, canopy cover class and understory shrub cover to ~2,750 acres

There are 3,312,000 acres of early and mid-seral coniferous forest habitat throughout the Sierra Nevada bioregion. The cumulative effects to early and mid-seral coniferous forest of Alternative 2 when added to all past, present and reasonably foreseeable future projects in the wildlife analysis includes the potential loss or conversion of ~1,072 acres, and changes to ~3,050 acres (<0.01%) of early and mid-seral coniferous forest habitat throughout the Sierra Nevada bioregion. The contribution of Alternative 2 to the above-indicated cumulative effects is 600-1,728 acres (~57%) of the 1,072-3,050 acres of early and mid-seral coniferous forest habitat with cumulative effects within the wildlife analysis area. The cumulative effects to 1,072-3,050 acres of early and mid-seral habitat due to all past, present and reasonably foreseeable future projects in the wildlife analysis area will not alter the existing trend in this habitat.

The cumulative effects to of Alternative 3 to early and mid-seral coniferous forest added to all past, present and reasonably foreseeable future projects in the wildlife analysis area includes potential loss or conversion of ~852 acres and changes to ~2,750 acres (<0.01%) of early and mid-seral coniferous forest habitat throughout the Sierra Nevada bioregion. The contribution of Alternative 3 to the above-indicated cumulative effects is 467-1,538 acres (~56%) of the 852-2,750 acres of early and mid-seral coniferous forest habitat with cumulative effects within the wildlife analysis area. The cumulative effects to 852-2,750 acres of early and mid-seral habitat due to all past, present and reasonably foreseeable future projects in the wildlife analysis area will not alter the existing trend in this habitat.

Summary of Mountain Quail Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit 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 South Shore 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).

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 net loss of 467-600 acres of early and mid-seral coniferous forest due to changes in CWHR size class from 1-4 to 5, the reduction in tree canopy cover across 1,538-1,728 acres of early and mid-seral coniferous forest, and the estimated reduction in understory shrub canopy closure within 631-389 acres out of a total of 24,157 acres of early and mid-seral coniferous forest habitat in the South Shore wildlife analysis area 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.

Late Seral Open Canopy Coniferous Forest Habitat (sooty [blue] grouse)

Habitat/species relationship

The sooty grouse was selected as the MIS for late seral open canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures less than 40%. Sooty grouse occurs in open, medium to mature-aged stands of fir, Douglas-fir, and other conifer habitats, interspersed with medium to large openings, and available water, and occupies a mixture of mature habitat types, shrubs, forbs, grasses, and conifer stands (CDFG 2005). Empirical data from the Sierra Nevada indicate that sooty grouse hooting sites are located in open, mature, fir-dominated forest, where particularly large trees are present (Bland 2006).

Habitat factors for the project-level effects analysis

- Acres of late seral open canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitat [CWHR ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), eastside pine (EPN), tree size 5, canopy closures S and P].

- Acres with changes in tree canopy closure class.
- Acres with changes in understory shrub canopy closure class.

Existing Conditions

Acres of late seral open canopy coniferous forest: A total of 443 acres of late seral open canopy coniferous forest exist within the South Shore wildlife analysis area.

Tree canopy closure class: The majority (90%) of late seral open canopy coniferous forest in the South Shore wildlife analysis area is characterized by tree canopy closure class P (25-39%), while only 10% of the acres are in tree cover class S (10-24%).

Understory shrub canopy closure class: Data for this habitat factor were not collected for every stand planned for treatment under the South Shore project, however, an existing dataset from the Multi Species Inventory and Monitoring (MSIM) project (LTBMU 2007) provided some on the ground data at 2 locations within late seral open coniferous forest in the South Shore wildlife analysis area. Vegetation data from the MSIM project, including understory shrub cover, were collected in 2002-2005. Shrub cover estimates at these stations varied from 30-35% cover, with an average of 32.5% shrub cover.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Acres of late seral open canopy coniferous forest: No acres of late seral open coniferous forest would be affected by the No Action alternative, because no treatments would be implemented as a result of this alternative.

Acres with changes in tree canopy closure class: The No Action alternative would result in no changes to tree canopy closure within late seral open coniferous forest, because no treatments would be implemented as a result of this alternative.

Acres with changes in understory shrub canopy closure class: The No Action alternative would result in no changes in understory shrub canopy closure within late seral open coniferous forest, because no treatments would be implemented as a result of this alternative.

Alternative 2 (Proposed Action) and Alternative 3

Acres of late seral open canopy coniferous forest: Approximately 400 acres of late seral open canopy conifer forest would be treated under both Alternative 2 and Alternative 3. No changes would be expected to occur within existing acres of late seral open canopy coniferous forest, as treatment impacts to existing late seral open canopy coniferous forest would not be expected to alter conditions enough to change the forest type. However, existing early and mid-seral coniferous forest would be expected to be converted to late seral open coniferous forest through removal of smaller understory trees and retention of larger overstory trees (see above analysis for early and mid-seral coniferous forest). Alternative 2 would change 442 acres of early and mid-seral forest, while Alternative 3 would change 314 acres of early and mid-seral forest to late seral open coniferous forest. Under both action alternatives an additional 14 acres of late seral closed canopy forest would be converted to late seral open canopy forest (see analysis for late seral closed canopy forest below). A net increase in late seral open canopy coniferous forest habitat in the wildlife analysis area would result from both action alternatives, with 456 acres (~103%) for Alternative 2 and 328 acres (~74%) for Alternative 3.

Acres with changes in tree canopy closure class: Treatment prescriptions within this habitat type are primarily focused on removing the smaller understory trees and are not intended to remove the overstory tree canopy. As a result, only 12 acres of late seral open canopy coniferous forest would be expected to result in a reduction in tree canopy closure class from P (25-39%) to S (10-24%) for both action alternatives. A change in canopy cover would occur for approximately 3% of late seral open canopy coniferous forest within the wildlife analysis area.

Acres with changes in understory shrub canopy closure class: Understory shrub cover would be changed under both action alternatives. Alternative 2 would affect 51 acres of late seral open coniferous forest with a change in shrub cover on 12% of this habitat type within the wildlife analysis area. Alternative 3 would affect 47 acres with a change in shrub cover on 11% of this habitat type within the wildlife analysis area. Effects of each unique treatment combination shown in Tables 3-114 and 3-115 on shrub cover have been previously described in the above analysis of direct and indirect effects for early and mid-seral coniferous forest.

Tables 3-114 and 3-115show expected effects of unique treatment combinations to understory shrub canopy cover from primary and secondary (i.e., follow up) treatments within late seral open coniferous forest under Alternatives 2 and 3.

Table 3-114. Alternative 2 treatments and effects to understory shrub cover in late seral open coniferous forest

Primary fuels treatment	Follow up fuels treatment	Treatment acres in late seral open coniferous forest	Treatment effects to understory shrub cover (% area affected)	Acres with changes in understory shrub canopy cover
Hand thin	Hand pile and burn	339	6	20
Whole tree removal	Landing pile burning	28	20	6
Cut-to-length	Chipping and mastication	23	70	16
Hand thin	Chipping and mastication	13	70	9

Table 3-115. Alternative 3 treatments and effects to understory shrub cover in late seral open coniferous forest

Primary fuels treatment	Follow up fuels treatment	Treatment acres in late seral open coniferous forest	Treatment effects to understory shrub cover (% area affected)	Acres with changes in understory shrub canopy cover
Hand thin	Hand pile and burn	367	6	22
Cut-to-length	Chipping and mastication	23	70	16
Hand thin	Chipping and mastication	13	70	9

Cumulative Impacts

Alternative 1 (No Action)

There would be no cumulative effect to late seral open canopy coniferous forest habitat due to the No Action alternative, because there would be no direct or indirect effects of this alternative to this habitat type.

Due to the lack of cumulative effects to late seral open canopy coniferous forest habitat, the No Action alternative would not alter the existing trend in the habitat.

Alternative 2 (Proposed Action)

A complete listing of past, present, and reasonably foreseeable future actions affecting MIS and special status species habitats is provided in the project BE/BA found in the project file. Projects affecting late seral open canopy coniferous forest habitat are primarily vegetation management projects. Impacts of these other vegetation management projects within the wildlife analysis area to late seral open canopy coniferous forest are similar to impacts described above for Alternatives 2 and 3of the South Shore project. Impacts of vegetation projects to habitat factors include: a reduction in total canopy cover (primarily that of the mid- and under-story components), and a short term reduction in understory shrub cover. Impacts of vegetation management actions in late seral open canopy coniferous forest are not anticipated to result in habitat type conversions; only changes to habitat factors within this habitat type are anticipated. Due to the conversion of some early and mid-seral coniferous forest to late seral open and closed canopy coniferous forest as a result of vegetation treatments, it is expected that some additional acres of late seral open canopy conifer forest may result from the cumulative impacts of vegetation projects that have or will occur in the wildlife analysis area.

Estimates of acres with changes to habitat factors and acres of loss due to vegetation projects throughout the wildlife analysis area were based on the percentage of treated acres in the South Shore project area that were anticipated to result in similar impacts to late seral open conifer habitat. Alternative 2 is expected to have changes to habitat factors on 13% of treated acres, and 12% of early and mid-seral habitats treated were expected to result in creation of late seral open canopy conifer forest. The cumulative impact of all past, present, and reasonably foreseeable future projects affecting late seral open canopy coniferous forest in the wildlife analysis area, including Alternative 2, would result in potential changes to tree canopy closure and understory shrub cover on ~64 acres, and creation of as much as 772 acres.

Alternative 3 is expected to produce similar changes to late seral open conifer habitat; 12% of treated acres are expected to have changes to habitat factors, and 9% of early and mid-seral habitats treated are expected to result in creation of late seral open canopy conifer forest. The cumulative impacts of all past, present, and reasonably foreseeable future projects affecting late seral open canopy coniferous forest in the wildlife analysis area, including Alternative 3, include: potential changes in tree canopy closure and understory shrub cover to ~59 acres, and creation of as much as 562 acres.

There are 75,000 acres of late seral open canopy coniferous forest habitat throughout the Sierra Nevada bioregion. The cumulative effects to late seral open canopy coniferous forest of all past, present and reasonably foreseeable future projects in the wildlife analysis area combined with Alternative 2 include potential changes to ~64 acres and possible creation of as much as 772 acres. For Alternative 3 potential changes would be expected on ~59 acres, with the possible creation of 562 acres. The contribution of Alternative 2 to cumulative effects is 51-442 acres (60-80%) of the 64-772 total acres of late seral open canopy coniferous forest habitat with cumulative effects from any source within the wildlife analysis area. Alternative 3 is expected to contribute 47-314 acres (56-80%) of the 59-562 acres with effects from any source within the wildlife analysis area. The cumulative effects of an increase of approximately 0.01% of late seral open canopy coniferous forest habitat due to all past, present and reasonably foreseeable future projects, when combined with either action alternative in the wildlife analysis area, will not alter the existing trend in this habitat.

Summary of Sooty Grouse Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit LRMP (as amended by the Sierra Nevada Forests [SNF] MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the sooty grouse; hence, the late seral open canopy coniferous forest effects analysis for the South Shore 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 sooty grouse. This information is drawn from the detailed information on habitat and population trends in the SNF bioregional MIS report (USDA Forest Service 2008).

Habitat status and trend

There are currently 75,000 acres of late seral open canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, red fir, and eastside pine) habitats on National Forest System lands in the Sierra Nevada. The trend is slightly decreasing (from 3% to 1% within the last decade on National Forest System lands).

Population status and trend

The sooty grouse has been monitored in the Sierra Nevada at various sample locations by hunter survey, modeling, point counts, and breeding bird survey protocols, including California Department of Fish and Game Blue (Sooty) Grouse Surveys (Bland 1993, 1997, 2002, 2006); California Department of Fish and Game hunter survey, modeling, and hunting regulations assessment (CDFG 2004a, CDFG 2004b); Multi-species inventory and monitoring on the Lake Tahoe Basin Management Unit (LTBMU 2007); and 1968 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007). These data indicate that sooty grouse continue to be present across the Sierra Nevada, except in the area south of the Kern Gap, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of sooty grouse populations in the Sierra Nevada north of the Kern Gap is stable.

Relationship of project-level habitat impacts to bioregional-scale sooty grouse trend

The reduction in overstory canopy cover within 12 acres, and the change in understory shrub canopy closure within 47-51 acres out of the total of 443 acres of this habitat type in the wildlife analysis area, will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of sooty grouse across the Sierra Nevada bioregion. The net increase of 328-456 acres of late seral open canopy coniferous forest habitat within the South Shore wildlife analysis area, while contributing to a relatively large (~100%) increase in this habitat type in the wildlife analysis area, is relatively insignificant across the Sierra Nevada bioregion, where there are currently 75,000 acres. Therefore, the increase in this habitat type in the South Shore project area also will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of sooty grouse across the Sierra Nevada bioregion.

Late Seral Closed Canopy Coniferous Forest Habitat (California spotted owl, American marten, and northern flying squirrel)

Habitat/species relationship

California spotted owl: The California spotted owl was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. The California spotted owl is strongly associated with forests that have a complex multi-layered structure, large-diameter trees, and high canopy closure (CDFG 2005, USFWS 2006). It uses dense, multi-layered canopy cover for roost seclusion; roost selection appears to be related closely to thermoregulatory needs, and the species appears to be intolerant of high temperatures (CDFG 2005). Mature, multi-layered forest stands are required for breeding (Ibid). The mixed-conifer forest type is the predominant type used by spotted owls in the Sierra Nevada: about 80 percent of known sites are found in mixed-conifer forest, with 10 percent in red fir forest (USDA Forest Service 2001).

American marten: The American marten was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. Martens prefer coniferous forest habitat with large diameter trees and snags, large down logs, moderate-to-high canopy closure, and an interspersion of riparian areas and meadows. Important habitat attributes are: vegetative diversity, with predominately mature forest; snags; dispersal cover; and large woody debris (Allen 1987). Key components for westside and eastside marten habitat can be found in the Sierra Nevada Forest Plan Amendment FEIS (USDA Forest Service 2001), Volume 3, Chapter 3, part 4.4, pages 20-21.

Northern flying squirrel: The northern flying squirrel was selected as an MIS for late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat in the Sierra Nevada. This habitat is comprised primarily of medium/large trees (equal to or greater than 24 inches dbh) with canopy closures above 40% within ponderosa pine, Sierran mixed conifer, white fir, and red fir coniferous forests, and multi-layered trees within ponderosa pine and Sierran mixed conifer forests. The northern flying squirrel occurs primarily in mature, dense conifer habitats intermixed with various riparian habitats, using cavities in mature trees, snags, or logs for cover (CDFG 2005).

Habitat factors for the project-level effects analysis

- Acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat [CWHR ponderosa pine (PPN), Sierran mixed conifer (SMC), white fir (WFR), red fir (RFR), tree size 5 (canopy closures M and D), and tree size 6].
- Acres with changes in canopy closure (D to M).
- Acres with changes in large down logs per acre or large snags per acre.

Existing Conditions

Acres of late seral closed canopy coniferous forest: A total of 481 acres of late seral closed canopy coniferous forest exist within the South Shore wildlife analysis area.

Canopy closure (D to M): The majority (75%) of late seral closed canopy coniferous forest in the South Shore wildlife analysis area is characterized by the moderate tree canopy closure class M (40-59%), while 25% of the acres are in the dense tree cover class D (60-100%).

Large down logs per acre or large snags per acre: An existing dataset from the multi-species inventory and monitoring (MSIM) project provided snag and downed wood data for 11 locations within late seral closed canopy coniferous forest throughout the South Shore wildlife analysis area; from the Cascade watershed to Burke Creek watershed. Vegetation data from the MSIM project, including snag densities and coarse woody debris volumes, were collected in 2002-2005. Stand exam data within 10 proposed treatment stands in late seral closed canopy forest were also collected in 2007 and provide additional information on existing snag and downed wood conditions in the project treatment area. Snag densities from common stand exams were calculated using weighted averages based on the size of the stand representing each snag density value. Snag densities from the MSIM data represent unweighted averages because sites did not vary in size. In general snag densities and downed wood volumes were lower in the South Shore project treatment area than throughout the wildlife analysis area. This is probably because fuels treatments were prioritized to occur in the Wildland-Urban intermix zone (WUI), where previous thinning and fuels treatments were likely to have already occurred as part of past projects.

<u>Large snags per acre</u>: MSIM data indicated an average of 3.5 large snags/acre > 30 inches dbh throughout the wildlife analysis area. Stand exam data indicated an average of 1.5 large snags/acre > 30 inches dbh.

<u>Large down logs per acre</u>: Based on the MSIM dataset, an average of 23.6 tons/acre of downed wood > 12 inches in diameter occurs in late seral closed canopy forest within the wildlife analysis area, while stand exam data indicated an average of only 1 ton/acre of similarly sized downed wood existing in late seral closed canopy forest in the project treatment area.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

<u>Acres of late seral closed canopy coniferous forest</u>: No acres of late seral closed canopy coniferous forest would be affected by the No Action alternative, because no treatments would be implemented as a result of this alternative.

<u>Acres with changes in canopy closure (D to M)</u>: - The No Action alternative would result in no changes in canopy closure from class D to M within late seral closed canopy coniferous forest, because no treatments would be implemented as a result of this alternative.

<u>Acres with changes in large down logs per acre or large snags per acre</u>: The No Action alternative would result in no changes in large down logs or large snags per acre within late seral closed canopy coniferous forest, because no treatments would be implemented as a result of this alternative.

Alternative 2 (Proposed Action) and Alternative 3

<u>Acres of late seral closed canopy coniferous forest</u>: Alternative 2 would treat approximately 280 acres and Alternative 3 would treat approximately 270 acres of late seral closed canopy conifer forest. Both action alternatives would result in a net increase in late seral closed canopy habitat; Alternative 2 would produce a net increase of 144 acres (30%), while Alternative 3 would produce a net increase of 139 acres (29%). Alternative 2 would create a total of 158 acres of late seral closed canopy forest from treatments in early-mid-seral coniferous forest, while Alternative 3 would create 153 acres. Both action alternatives would convert 14 acres of existing late seral closed canopy forest to late seral open canopy forest.

<u>Acres with changes in canopy closure (D to M)</u>: Of the 481 acres of existing late seral closed canopy forest occurring in the wildlife analysis area, 70 acres would have canopy closure class reductions from dense (60-100%) to moderate (40-59%) due to thinning treatments in both action alternatives. This represents potential impacts to canopy closure in 15% of late seral closed canopy forest in the wildlife analysis area. Canopy cover reductions would result primarily from thinning of the smallest trees in the stand in order to meet fuels reduction objectives.

Acres with changes in large down logs per acre or large snags per acre: All proposed treatment stands in late seral closed canopy forest with large snags or large down logs present, and in quantities greater than the minimum retention standards set forth by the Forest Plan, have the potential for reductions in these factors due to treatments planned as part of both action alternatives. In Alternative 2, a total of 31 acres (6%) of late seral closed canopy coniferous forest in the wildlife analysis area containing either large snags or downed logs above minimum retention levels would be expected to have a reduction in snag densities or log volumes. Alternative 3 would be likely to have a similar reduction on 20 acres (4%). Effects under either action alternative to these acres include: 1) a reduction primarily in large downed logs per acre to a minimum of 10 tons/acre on average (as defined by project design features) in order to reduce fire risk, and 2) to a lesser extent a reduction in large snags/acre; since only hazard snags greater than 30 inches dbh would be removed as part of either action alternative.

Cumulative Impacts

Alternative 1 (No Action)

There would be no cumulative effects to late seral closed canopy coniferous forest habitat due to the No Action alternative, because there would be no direct or indirect effects of this alternative to this habitat type.

Due to the lack of cumulative effects to late seral closed canopy coniferous forest habitat, the No Action alternative would not alter the existing trend in the habitat.

Alternative 2 (Proposed Action)

A complete listing of past, present, and reasonably foreseeable future actions affecting MIS and special status species habitats as well as a description of the cumulative effects analysis area is provided in the project BE/BA in the project file. Projects affecting late seral closed canopy coniferous forest habitat are primarily vegetation management projects. Impacts of these other vegetation management projects within the wildlife analysis area to late seral open canopy coniferous forest are similar to impacts described above for the South Shore project action alternatives. Impacts of vegetation projects to habitat factors include: reduction in total canopy cover (primarily that of the mid- and under-story components, but in some cases of the overstory tree canopy closure); reduction in small/medium downed log and snag densities primarily due to design features, but occasionally large downed log and large snag densities in areas with high fuels risk or areas with hazard trees. Due to the conversion of some early and mid-seral coniferous forest to late seral open and closed canopy coniferous forest as a result of vegetation treatments, some additional acres of late seral closed canopy conifer forest are expected from the cumulative impacts of vegetation projects that have or will occur in the wildlife analysis area.

Estimates of acres with changes to habitat factors and acres of loss due to vegetation projects in the wildlife analysis area were based on the percentage of treated acres in the South Shore project area that were anticipated to result in similar impacts to late seral closed conifer habitat. For the action alternatives, 25% of treated acres are anticipated to have changes to habitat factors in Alternative 2, and 26 % of treated acres would be affected in Alternative 3. For both action alternatives, 4% of early and mid-seral habitats treated are expected to result in creation of late seral closed canopy conifer forest. Cumulatively, ~120 acres of late seral closed canopy coniferous forest are estimated to result in changes to habitat factors, and as many as 254 acres of late seral closed canopy conifer forest may be created due to past, present and reasonably foreseeable future projects in the wildlife analysis area when combined with Alternative 2. For Alternative 3, the cumulative changes to habitat factors are estimated to be ~122 acres, and up to 249 acres of late seral habitat creation is expected to occur.

There are 994,000 acres of late seral closed canopy coniferous forest habitat throughout the Sierra Nevada bioregion. The cumulative effects to late seral closed canopy coniferous forest of all past, present and reasonably foreseeable future projects in the wildlife analysis area when combined with the action alternatives of the South Shore project would result in potential changes to between 120 and 122 acres and possible creation of between 249 and 254 acres of closed canopy coniferous forest habitat. Cumulative effects are expected on less than 0.01% o the f 994,000 acres of late seral closed canopy coniferous forest habitat throughout the Sierra Nevada bioregion. The contribution of Alternative 2 to cumulative effects within the wildlife analysis area is 70-144 acres (~58%) of the 120-254 total acres of habitat with cumulative effects from all sources within the wildlife analysis area. The contribution of Alternative 3 to these cumulative effects is 70-139 acres (~58%) of the 122-249 total acres of late seral closed canopy coniferous forest habitat with cumulative effects from all sources within the wildlife analysis area. The cumulative effects to 120-254 acres of late seral closed canopy coniferous forest habitat due to either action alternative when combined with all other past, present and reasonably foreseeable future projects in the wildlife analysis area will not alter the existing trend in this habitat.

Summary of Status and Trend at the Bioregional Scale

California spotted owl, American marten, and northern flying squirrel

The Lake Tahoe Basin Management Unit LRMP (as amended by the SNF MIS Amendment) requires bioregional-scale habitat and distribution population monitoring for the California spotted owl, American marten, and northern flying squirrel; hence, the late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat effects analysis for the South Shore 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. This information is drawn from the detailed information on habitat and population trends in the SNF bioregional MIS report (USDA Forest Service 2008).

Habitat status and trend

There are currently 994,000 acres of late seral closed canopy coniferous forest (ponderosa pine, Sierran mixed conifer, white fir, and red fir) habitat on National Forest System lands in the Sierra Nevada. The trend is slightly increasing (from 7% to 9% within the last decade on National Forest System lands).

Population status and trend

California spotted owl has been monitored in California and throughout the Sierra Nevada through general surveys, monitoring of nests and territorial birds, and demography studies (Verner et al. 1992; USDA Forest Service 2001, 2004, 2006; USFWS 2006; Sierra Nevada Research Center 2007). Current data at the rangewide, California, and Sierra Nevada scales indicate that, although there may be localized declines in population trend [e.g., localized decreases in “lambda” (estimated annual rate of population change)], the distribution of California spotted owl populations in the Sierra Nevada is stable.

American marten has been monitored throughout the Sierra Nevada as part of general surveys and studies from 1996-2002 (Zielinski et al. 2005). Since 2002, the American marten has been monitored on the Sierra Nevada forests as part of the Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan (USDA Forest Service 2005, 2006, 2007b). Current data at the rangewide, California, and Sierra Nevada scales indicate that, although marten appear to be distributed throughout their historic range, their distribution has become fragmented in the southern Cascades and northern Sierra Nevada, particularly in Plumas County. The distribution appears to be continuous across high-elevation forests from Placer County south through the southern end of the Sierra Nevada.

Northern flying squirrel has been monitored in the Sierra Nevada at various sample locations by live-trapping, ear-tagging, camera surveys, snap-trapping, and radiotelemetry: 2002-present on the Plumas and Lassen National Forests (Sierra Nevada Research Center 2007), and 1958-2004 throughout the Sierra Nevada in various monitoring efforts and studies (see USDA Forest Service 2008, Table NOFLS-IV-1). These data indicate that northern flying squirrels continue to be present at these sample sites, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of northern flying squirrel populations in the Sierra Nevada is stable.

Relationship of project-level habitat impacts to bioregional-scale trends

<u>California spotted owl</u>: The addition of 139-144 acres of late seral closed canopy forest, the changes in canopy closure of 70 acres, and the potential changes in large snag and log densities within 20-31 acres out of 481 acres of late seral closed canopy coniferous forest habitat in the South Shore wildlife analysis area, and 994,000 acres in the Sierra Nevada, will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of California spotted owl across the Sierra Nevada bioregion.

<u>American marten</u>: The addition of 139-144 acres of late seral closed canopy forest, the changes in canopy closure of 70 acres, and the potential changes in large snag and log densities within 20-31 acres out of 481 acres of late seral closed canopy coniferous forest habitat in the South Shore wildlife analysis area, and 994,000 acres in the Sierra Nevada, will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of American marten across the Sierra Nevada bioregion.

<u>Northern flying squirrel</u>: The addition of 139-144 acres of late seral closed canopy forest, the changes in canopy closure of 70 acres, and the potential changes in large snag and log densities within 20-31 acres out of 481 acres of late seral closed canopy coniferous forest habitat in the South Shore wildlife analysis area, and 994,000 acres in the Sierra Nevada, will not alter the existing trend in the habitat, nor will it lead to a change in the distribution of Northern flying squirrel 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 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).

Habitat factors for the project-level effects analysis

- Medium (15-30 inches dbh) snags per acre.
- Large (greater than 30 inches dbh) snags per acre.

Existing Conditions

A total of 60,193 acres of green forest containing a snag component exist within the wildlife analysis area. Data from two sources were available for characterizing snag densities in green forest within the wildlife analysis area: common stand exam data collected within each of approximately 200 proposed treatment stands, and vegetation condition data collected at 48 sites in the wildlife analysis area as part of the Multi-Species Inventory and Monitoring (MSIM) project in 2002-2005. Snag densities from common stand exams were calculated using weighted averages based on the size of the stand representing each snag density value. Snag densities from the MSIM data represent un-weighted averages because sites did not vary in area.

Medium (15-30 inches dbh) snags per acre: Medium snag densities of 4.5 snags per acre were observed at MSIM sites within green forest throughout the South Shore wildlife analysis area, while stands within the proposed treatment areas in green forest averaged 6.96 medium snags per acre.

Large (greater than 30 inches dbh) snags per acre: MSIM data indicated an average of 1.29 large snags per acre in green forest throughout the South Shore wildlife analysis area, while stands within the proposed treatment areas averaged 1.1 large snags per acre.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

No changes in the total area of green forest habitat containing snags are anticipated due to the No Action alternative of the South Shore project, because no treatments are planned under this alternative.

Medium (15-30 inches dbh) snags per acre: Medium snag densities in green forest would not be affected by the No Action alternative, because no treatments would be implemented as a result of this alternative.

Large (greater than 30 inches dbh) snags per acre: Large snag densities in green forest would not be affected by the No Action alternative, because no treatments would be implemented as a result of this alternative.

Alternative 2 (Proposed Action) and Alternative 3

No changes in the total area of green forest habitat containing snags would be anticipated as a result of the action alternative in the South Shore project; minimum levels of snag retention per acre have been established in the Forest Plan. However, changes to snag densities among acres of green forest treated would be anticipated as discussed below. A total of 10,670 acres of green forest habitat containing snags would be treated under Alternative 2, and 10,112 acres would be treated under Alternative 3..

Medium (15-30 inches dbh) snags per acre: Forest Plan guidelines and project design features require minimum snag retention levels of 3-8 medium to large snags per acre on average; therefore, only treatment stands with an average snag density > 3 medium to large snags per acre would have snags removed as part of either action alternative. Effects of Alternative 2 on medium snag density in green forest include the potential reduction in snag density in an estimated 5,517 acres, which represents the acres of stands proposed for treatment that currently contain greater than 3 medium to large snags per acre. Because minimum snag retention levels have been identified in the project design features, medium snag densities would not be reduced below 3 snags/acre in the absence of larger sized snags, and likely not below 2 snags/acre in the presence of larger snags (which currently average ~1/acre). Out of the total 60,193 acres in the wildlife analysis area containing snags in green forest, the 5,517 acres that would be treated under Alternative 2 represent a potential change in medium snag density within 9% of the wildlife analysis area. Alternative 3 would treat 5,376 acres, which would also project a change in snag density for 9% of the wildlife analysis area.

Large (greater than 30 inches dbh) snags per acre: Due to project design features limiting removal of snags > 30 inches dbh, either of the action alternatives would have a very limited effect on large snag densities in green forest throughout the wildlife analysis area. Only hazard trees greater than 30 inches dbh would be removed adjacent to established infrastructure (e.g., houses, roads/trails, etc).

Cumulative Impacts

Alternative 1 (No Action)

There are no cumulative effects to late snags in green forest due to the No Action alternative, because there are no direct or indirect effects of this alternative to this habitat type.

Due to the lack of cumulative effects to snags in green forest habitat, the No Action alternative would not alter the existing trend in the habitat.

Alternative 2 (Proposed Action)

Of the list of projects affecting MIS and special status species habitats contained in the BE/BA found in the project file, those affecting snags in green forest habitat are primarily vegetation management projects, plus engineering and stream restoration projects to a limited extent. The maximum number of acres with potential reductions in medium and large snag densities throughout the wildlife analysis area from treatments in all past, present, and reasonably foreseeable future vegetation management projects is approximately 8,280 acres in Alternative 2 and 8,140 acres in Alternative 3. Vegetation management projects remove snags only when necessary to meet fuels reduction or safety objectives, and on average retain a minimum of 3-8 medium to large snags per acre, per Forest Plan guidelines and project design features. These levels of snag retention are within the range of average snag densities observed across the Sierra Nevada bioregion.

The cumulative effects to snags in green forest from all past, present and reasonably foreseeable future projects in the wildlife analysis area when combined with Alternative 2 would reduce medium and large snags densities to 3-8 snags/acre within ~8,280 acres of green forest within the wildlife analysis area. The cumulative acreage for Alternative 2 is approximately 8,280, while the cumulative acreage for Alternative 3 is 8,140. Alternative 2 would change snag densities on an estimated 5,517 acres, which represents 67% of the total cumulative effects within the wildlife analysis area under Alternative 2. Alternative 3 would change snag densities on an estimated 5,376 acres, which represents 66% of the total cumulative effects within the wildlife analysis area under Alternative 3. The potential cumulative reduction in snag densities within between 8,140 and 8,280 acres of green forest due to the combination of either action alternative plus all past, present and reasonably foreseeable future projects in the wildlife analysis area will not alter the existing trend in this habitat element across the Sierra Nevada Bioregion. These reduced snag densities are within the range of snag densities observed across the Sierra Nevada bioregion.

Summary of Hairy Woodpecker Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit 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 South Shore 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).

Ecosystem component status and trend

The current (based on 2001-2004 inventory sources) average number of medium-sized and large-sized snags (> 15" 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 potential changes in medium-sized snags per acre on 5,376-5,517 acres out of 60,193 acres in the South Shore wildlife analysis area will not alter the existing trend in medium or large snag densities in green forest, nor will it lead to a change in the distribution of hairy woodpecker across the Sierra Nevada bioregion.

Snags in Burned Forest Ecosystem Component (black-backed woodpecker)

Habitat/species relationship

The black-backed woodpecker was selected as the MIS for the ecosystem component of snags in burned forests. Recent data indicate that black-backed woodpeckers are dependent on snags created by stand-replacement fires (Hutto 1995, Kotliar et al. 2002, Smucker et al. 2005). The abundant snags associated with severely burned forests provide both prey (by providing food for the specialized beetle larvae that serve as prey) and nesting sites (Hutto and Gallo 2006).

Habitat factors for the project-level effects analysis

- Medium (15-30 inches dbh) snags per acre within burned forest created by stand-replacing fire.
- Large (greater than 30 inches dbh) snags per acre within burned forest created by stand-replacing fire.

Existing Conditions

A total of 3,614 acres of burned forest containing a snag component exist within the wildlife analysis area. Data from common stand exam data were available for characterizing snag densities in burned forest within the project proposed treatment areas; 12 stands dominated by burned forest were surveyed for snags. Average snag densities in burned forest were calculated using weighted averages based on the size of each stand.

Medium (15-30 inches dbh) snags per acre: An average of 13.9 medium snags occur per acre in burned forest within the wildlife analysis area.

Large (greater than 30 inches dbh) snags per acre: An average of 2.3 large snags occur per acre within burned forest stands in the wildlife analysis area, based on data from 12 burned stands in the wildlife analysis area.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

No changes in the total area of burned forest habitat containing snags would be anticipated due to the No Action alternative of the South Shore project, because no treatments would occur under this alternative.

Medium (15-30 inches dbh) snags per acre: Medium snag densities in burned forest would not be affected by the No Action alternative, because treatments would not be implemented as a result of this alternative.

Large (greater than 30 inches dbh) snags per acre: Large snag densities in burned forest would not be affected by the No Action alternative, because treatments would not be implemented as a result of this alternative.

Alternative 2 (Proposed Action)

No changes in the total area of burned forest habitat containing snags would be anticipated due to Alternative 2 or 3 of the South Shore project; minimum levels of snag retention per acre have been established in the Forest Plan. However, changes to snag densities among acres of burned forest treated are anticipated as discussed below.

Medium (15-30 inches dbh) snags per acre: The same area of burned forest would be treated under Alternatives 2 and 3; therefore, 315 acres of burned forest may have medium snag densities reduced. This represents the acres of burned forest in the wildlife analysis area that currently contain greater than 3 medium to large snags per acre. Forest Plan guidelines require minimum snag retention levels of 3 medium to large snags per acre on average; hence, only treatment stands with an average snag density > 3 per acre would be anticipated to have snags removed as part of project proposed actions under either action alternative. Out of the total 3,614 acres in the wildlife analysis area containing snags in burned forest, this represents a change in medium snag density within 9% of burned forest in the wildlife analysis area. Because minimum snag retention levels have been identified as project design features, medium snag densities would not be reduced below 3 snags/acre when there is an absence of larger sized snags, or not below ~1 snag/acre in the presence of larger snags (which currently average 2.3 snags/acre).

Large (greater than 30 inches dbh) snags per acre: Due to project design features limiting removal of snags > 30 inches dbh, both action alternatives would have limited effect on large snag densities in burned forest in the wildlife analysis area; only hazard trees would be removed adjacent to established infrastructure (e.g., houses, roads/trails, etc).

Because burned forests contain higher snag densities than green forests in the wildlife analysis area, the potential reduction in snag density within burned forest would be greater than the reduction in green forest.

Cumulative Impacts

Alternative 1 (No Action)

There are no cumulative effects to snags in burned forest habitat due to the No Action alternative, because there would not be direct or indirect effects of this alternative to this habitat type.

Due to the lack of cumulative effects to snags in burned forest habitat, the No Action alternative would not alter the existing trend in the habitat.

Alternative 2 (Proposed Action)

The list of projects affecting snags in burned forest habitat includes vegetation management projects and restoration projects within burned forest, primarily future projects proposed within the Angora Fire burn area. The total acreage of this habitat treated, or proposed for treatment in all past, present, and reasonably foreseeable future vegetation management projects combined with either South Shore project action alternative is ~3,075 acres. This represents the cumulative acreage of burned forest with potential reductions in medium and large snag densities in the wildlife analysis area. Vegetation management projects remove snags when necessary to meet fuels reduction or safety objectives, and on average retain a minimum of 3-8 medium to large snags per acre, per Forest Plan guidelines and project design features. These levels of snag retention are within the range of average snag densities observed across the Sierra Nevada bioregion.

There are 211,000 acres of burned forest throughout the Sierra Nevada bioregion. The cumulative effects to snags in burned forest of all past, present and reasonably foreseeable future projects in the wildlife analysis area, including either Alternative 2 or 3 of the South Shore project, would produce a potential reduction of medium and large snags densities to 3-8 snags/acre within ~3075 acres in the wildlife analysis area. The resulting snag densities are within the range of snag densities observed across the Sierra Nevada bioregion. Either action alternative would contribute 10% to the total cumulative effects within the wildlife analysis area from the estimated 315 acres may have changes in snag densities. The potential cumulative effects to snag densities within ~3,075 acres of burned forest due to all past, present and reasonably foreseeable future projects in the wildlife analysis area will not alter the existing trend in this habitat element across the Sierra Nevada Bioregion.

Summary of Black-backed Woodpecker Status and Trend at the Bioregional Scale

The Lake Tahoe Basin Management Unit LRMP (as amended by the SNF MIS amendment) requires bioregional-scale habitat and distribution population monitoring for the black-backed woodpecker; hence, the snags effects analysis for the South Shore 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 black-backed 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).

Ecosystem component status and trend

The current (based on 2001-2004 inventory sources) average number of medium-sized and large-sized snags (> 15" 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). These data include snags in both green forest and burned forest. 211,000 acres were severely burned in the Sierra Nevada between 2000 and 2007.

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 black-backed woodpecker has been monitored in the Sierra Nevada at various sample locations by avian point counts, spot mapping, mist-netting, and breeding bird survey protocols, including: on-going monitoring through California Partners in Flight Monitoring Sites (CPIF 2002); 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); 1970 to present – various Sierra Nevada monitoring and study efforts (see USDA Forest Service 2008, Table BLWO-IV-1); and 1971 to present – BBS routes throughout the Sierra Nevada (Sauer et al. 2007). These data indicate that black-backed woodpecker continue to be distributed across the Sierra Nevada, and current data at the rangewide, California, and Sierra Nevada scales indicate that the distribution of black-backed woodpecker populations in the Sierra Nevada is stable.

Relationship of project-level habitat impacts to bioregional-scale trend

The potential change in snag densities, primarily in medium-sized snags, on 315 acres out of 3,614 acres of burned forest in the South Shore wildlife analysis area will not alter the existing trend in the ecosystem component, nor will it lead to a change in the distribution of black-backed woodpecker across the Sierra Nevada bioregion.

Comparison of Alternative Effects

Anticipated effects of the action alternatives considered under the South Shore project on MIS Habitat are summarized below (Table 3-116).

Table 3-116. Summary of pre-treatment MIS habitat acres as a result of each alternative

MIS habitat or ecosystem component	Pre-treatment MIS habitat acres (same as no action)	Post-treatment MIS habitat acres Alt.2	Change in MIS habitat acres Alt. 2	Post-treatment MIS habitat acres Alt.3	Change in MIS Habitat acres Alt. 3
Riverine & Lacustrine[1]	225 miles stream; 2,665 acres lacustrine	225 miles/ 2,665 acres	0	225 miles/ 2,665 acres	0
Riparian[2]	3,658	3,658	0	3,658	0
Wet meadow[3]	1,283	1,398	+115	1,382	+99
Coniferous forest, early and mid-seral[4]	24,157	23,557	-600	23,690	-467
Coniferous forest, late seral, open canopy[4]	443	899	+456	771	+328
Coniferous forest, late seral, closed canopy[4]	481	625	+144	620	+139
Snags in green forest[5]	60,193	60,193	0	60,193	0
Snags in burned forest[6]	3,614	3,614	0	3,614	0

[1] Riverine habitat is defined as miles of perennial streams and was based on the existing stream data. Lacustrine habitat is defined as area covered by water in the existing vegetation data layer.

[2] Riparian habitat is defined as deciduous and mixed deciduous/conifer riparian types based on the existing riparian vegetation data. The deciduous riparian type encompasses some SEZs.

[3] Meadow habitat was defined as CWHR designated wet meadow habitat within the existing vegetation data layer. Wet meadow systems also include some SEZs.

[4] Acres of all coniferous forest habitat types were calculated using the area of each respective habitat type within the existing vegetation data, but outside recent fire area perimeters (see note 6 below).

[5] Snags in green forest habitat (i.e., containing medium to large snags) is defined as CWHR size class 4 (> 24 inch dbh) or greater, with any canopy cover class (S, P, M or D), but outside recent fire area perimeters (see note 6 below).
[6] Snags in burned forest includes acres designated as CWHR size class 4 or greater in any canopy cover class, and within the boundaries of wildfires occurring in the last 10 years (Angora Fire: 2007, Cathedral Fire: 2006, Showers Fire: 2002, Gondola Fire: 2002, Pioneer Fire: 2002 and Kiva Fire: 2002).

The change in acres by alternative for individual habitat factors of MIS habitat types is displayed below in Table 3-117.

Table 3-117. Summary of MIS habitat acres within the South Shore project wildlife analysis area and acres with changes to individual habitat factors as a result of each alternative

MIS habitat and habitat factors	Acres in project wildlife analysis area	Acres with changes to habitat factors Alt. 1	Acres with changes to habitat factors Alt. 2	Acres with changes to habitat factors Alt. 3
Riverine & Lacustrine	225 miles stream; 2,665 acres lacustrine	0	21 miles stream; 9 acres lacustrine	20 miles stream 4 acres lacustrine
Flow	N/A	N/A	N/A	N/A
Sedimentation	N/A	N/A	N/A	N/A
Water Surface Shade	N/A	N/A	N/A	N/A
Riparian	3,658	0	496	466
Deciduous canopy cover	2,014	0	496	466
Total Canopy Cover	3,658	0	240	176
CWHR size class	3,658	0	179	140
Wet Meadow	1,283	0	115	99
CWHR herbaceous height class	N/D	N/D	N/D	N/D
CWHR herbaceous ground cover class	N/D	N/D	N/D	N/D
meadow hydrology	N/A	N/A	N/A	N/A
Coniferous Forest, early and mid-seral	24,157	0	600	467
CWHR size class	24,157	0	600	467
tree canopy cover class	24,157	0	1,728	1,538
understory shrub cover	25,157	0	689	631
Coniferous Forest, late seral, open canopy	443	0	456	328
tree canopy cover class	443	0	12	12
understory shrub cover	443	0	51	47
Coniferous Forest, late seral, closed canopy	481	0	144	139
tree canopy cover (from D-M)	481	0	70	70
Large log/large snag density	481	0	31	20
Snags in green forest	60,193	0	10,670	10,112
medium snag density	60,193	0	5,517	5,376
large snag density	60,183	0	minimal	minimal
Snags in burned forest	3,614	0	0	0
medium snag density	3,614	0	315	315
large snag density	3,614	0	minimal	minimal

N/A = Not Applicable; N/D = No Data

I. Sensitive Plants

Scope of the Analysis, Indicators, and Issues

None of the species considered here require consultation with the USFWS, however the *Rorippa subumbellata* (Tahoe yellow cress), is a candidate species for federal listing and exists within close proximity of the proposed project. On April 18, 2008 the LTBMU asked the USFWS, Reno Office if Technical Assistance would be required for the Tahoe yellow cress for the South Shore project. On April 25, 2008 the USFWS replied that after review of the current action alternatives technical assistance would not be needed.

Species considered are based on the January 31, 2008 (verified on August 14, 2008) list of federally threatened, endangered, proposed, and candidate species for the Lake Tahoe Basin Management Unit (LTBMU) from the USDI. Fish and Wildlife Service (USFWS; http://sacramento.fws.gov/es/spp_list.htm). The USDA Forest Service's botanical sensitive species list is based on the Pacific Southwest Region's list of 2006. These lists are the most current versions for the LTMBU. All applicable standards and guidelines from the LTBMU – LRMP (USDA FS 1988) and associated amendments (USDA FS 2004), and other applicable laws and regulations will be applied to this project.

The scope of analysis for sensitive plant existing conditions and effects in the South Shore project area is defined as the area where the vegetation treatments would occur under the action alternatives, or adjacent to vegetation treatment areas, because that is the area of potential direct, indirect and cumulative effects. Indicators of implementation of the design criteria for the action alternatives would be that the flagged plant populations remain intact throughout project activities. The objective of the design criteria for sensitive plants given in Chapter 2 of this EIS is to protect sensitive plant populations. Complete species listings and analysis details are given in the Biological Evaluation for sensitive plants, located in the project file and incorporated here by reference.

Existing Conditions

In addition to known locations of sensitive plants, sensitive plant surveys were conducted in June, July, and August of 2005, 2006, 2007, and 2008 by Forest Service TEAMS planning enterprise crew and LTBMU botany staff (Map 18). A review of the LTBMU flora atlases and available GIS coverage was performed to evaluate the extent of potential habitat within the proposed project areas. Botanical surveys conducted in the proposed project areas focus on species with potential habitat; however, surveys are floristic in nature and attempts are made to identify all plants encountered in the field. Many species have specific habitat preferences (such as wet meadows, fens, or granite scree), and botanists search for these as well as their associated species. Species that do not have potential habitat in the project area are not analyzed in this EIS. The following threatened (T), endangered (E), proposed (P), candidate (C), and/or Forest Service Sensitive (FSS) botanical species or their habitat are located within or in close proximity to the South Shore project treatment areas:

- Sensitive plant species that exist within the footprint of the proposed project:

  Botrychium acendens, upswept moonwort
  Meesia triquetra, three-ranked hump-moss
  Meesia uliginosa, broad-nerved hump-moss

- Sensitive plant species with suitable habitat within the footprint of the proposed project:

Arabis rigidissima var. *demota*, Galena Creek rock cress
Botrychium acendens, upswept moonwort
Botrychium crenulatum, scalloped moonwort
Botrychium lineare, slender moonwort
Botrychium lunaria, common moonwort
Botrychium minganense, Mingan moonwort
Botrychium montanum, western goblin
Bruchia bolanderi, Bolander's candle moss
Epilobium howellii, subalpine fireweed
Erigeron miser, starved daisy
Eriogonum umbellatum var. torreyanum, Donner Pass buckwheat
Helodium blandowii, Blandow's bog-moss
Hulsea brevifolia, short-leaved hulsea
Lewisia kelloggii ssp. hutchisonii and L. kelloggii ssp kelloggii, Kellogg's lewisia
Meesia triquetra, three-ranked hump-moss
Meesia uliginosa, broad-nerved hump-moss
Peltigera hydrothyria, veined water lichen

- Candidate for listing and sensitive plant species that exists within close proximity of the proposed project:

Rorippa subumbellata, Tahoe yellow cress

Project surveys located one occurrence of LTBMU sensitive plant species *Botrychium acendens* (upswept moonwort). One sensitive plant community, a fen, with the LTBMU special interest species *Sphagnum spp*. (sphagnum mosses), was also identified during these project surveys.

Known from previous surveys are two occurrences of the LTBMU sensitive plant species *Meesia triquetra* (three-ranked hump-moss) and two occurrences of the LTBMU sensitive plant species *Meesia uliginosa* (broad-nerved hump-moss), one of which is within a fen. There are also two populations of sphagnum moss located near Osgood Swamp, known from prior surveys. Another fen in the Grass Lake research natural area (RNA) exists within the vicinity of the proposed project, adjacent to, but not within the proposed project footprint. This fen has large populations of both three-ranked hump-moss and sphagnum moss. *Rorippa subumbellata* (Tahoe yellow cress), a US Forest Service sensitive plant and US Fish and Wildlife Service (USFWS) candidate species for listing under Endangered Species Act (ESA) of 1973, as amended, exists within close proximity of the proposed project.

There are several different habitats within the footprint of the South Shore DEIS project area. The forested habitat consists of mixed conifer forest with an overstory dominated by *Pinus Jeffreyi* (Jeffrey pine) and *Abies concolor* (white fir). *Calocedrus decurrens* (incense cedar) and *Pinus contorta* (lodgepole pine) can be found within this community as well. The understory is shrub dominated consisting of *Arctostaphylos patula* (green-leaf manzanita), *Purshia tridentata* (bitterbrush), *Ceanothus cordulatus* (whitethorn), *Ceanothus prostratus* (mahala mat), *Symphoricarpos spp*. (snowberries), *Ribes spp*. (gooseberries and currants), and *Chrysolepis sempervirens* (sierra chinquapin). The herbaceous layer is dominated by sparse forb and graminoid (grass) communities.

The dry meadow habitat type within the South Shore project is a plant community dominated by xeric (dry) graminoids and forbs. There is a shrub layer that usually consists of green-leaf manzanita, bitterbrush, *Artemisia tridentata* ssp. *vaseyana* (mountain sagebrush), and sierra chinquapin, and may contain *Salix spp*. (willows). The overstory is limited and sparse consisting mostly of encroaching lodgepole pine and white fir.

The stream environment zone (SEZ) within the proposed project has an overstory dominated by mixed conifers and *Populus tremuloides* (quaking aspen) in some areas. The shrub layer is dominated by willows and *Alnus incana* ssp. *tenuifolia* (mountain alder). The herbaceous layer is dominated by mesic (moisture-loving) forbs and graminoids.

The wet meadow/fen habitat within the project area (Map 18) is dominated by mosses, mesic forbs, and mesic graminoids. The shrub layer includes willows, *Lonicera ssp*. (honeysuckles), and *Vaccinium uliginosa* (western blueberry). The overstory is dominated by encroaching lodgepole pine.

Fens in the Sierra Nevada are important biologically diverse ecosystems that provide habitats for many rare vascular and nonvascular plants. Fens are ground water formed wetlands. Saturated soils with low oxygen content drive plant species to grow faster than their carbon and litter can decay. Organic soils or peat accumulates in fens very slowly over time. In a fen at least forty cm out of the top eighty cm of soil must be peat or organic soils. Sedges including *Carex utriculata* (beaked sedge), *Carex nebrascensis* (Nebraska sedge), and *Carex aquatilis* (water sedge) with deep rhizomatous root masses are an essential component of fens. These sedges help develop and provide stability for peat layers. Other plant species including *Drosera rotundifolia* (sundew), and mosses such as sphagnum moss, *Drepanocladus sp. (*drepanocladus moss), and *Philonotis sp*. (Philonotis moss) are also important in forming peat. (USDA Forest Service, Region 5 Draft Fen Assessment, 2007)

Fens in the National Forests of the Sierra Nevada are considered "special aquatic features" and receive a default riparian conservation area buffer width of 300 feet from the edge of the fen (USDA Forest Service 2004, pg 339). Standards and guidelines for these special aquatic features are listed on pages 340-349 of the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2004). Although these standards and guidelines are intended to maintain or restore the geomorphic and biological characteristics of fens and other aquatic features, they do not prohibit other forest activities such as fuel reduction. (USDA Forest Service 2004, pg 345).

There are two biodiversity areas and two fens found within the footprint of the South Shore project area. In addition the Grass Lake RNA is located adjacent to the proposed project footprint. The Angora Fen located in a treatment stand is known from the LTBMU prior to project surveys. The Angora Fen has an occurrence of three-ranked hump-moss and an occurrence of broad-nerved hump-moss. The second fen was found within the footprint of the project during project surveys conducted in 2006. This sensitive area is a sphagnum fen composing of different Sphagnum moss species. The additional two biodiversity areas are known from the LTBMU prior to project surveys are located adjacent to Osgood Swamp in two treatment stands, and both have occurrences of sphagnum moss. Grass Lake is the largest sphagnum fen in California and the best representation of a floating fen in the Sierra Nevada. There are 360 acres in the Grass Lake RNA. The RNA has the three-ranked hump-moss and the sphagnum moss. The populations of these plant species are large with a high percent cover throughout many acres in the RNA. Permanent monitoring plots have been established within the RNA by the LTBMU botany department. In addition the populations have been mapped and recorded.

The Tahoe Regional Planning Agency (TRPA) has established environmental thresholds for uncommon plant communities and sensitive plants. These environmental thresholds are used to establish the significance of an environmental affect to vegetation resources in the Lake Tahoe Basin. TRPA environmental thresholds include: provide for the non-degradation of the natural qualities of any plant community that is uncommon to the Basin or of exceptional scientific, ecological, or scenic value. This threshold applies to Grass Lake RNA and Osgood swamp within or adjacent to the South Shore project area.

Direct and Indirect Environmental Consequences

Direct effects occur when sensitive plants or their potential habitat are physically impacted by activities associated with the proposed action. Direct impacts may include: physically breaking, crushing, or uprooting sensitive plants by driving over them, covering them with wood chips or slash, and prescribed fire treatments. Individuals may be displaced by compromising suitable sensitive plant habitat, including changing the hydrology to sensitive plant communities. When plants are damaged, those individuals may experience altered growth and development, reduced or eliminated seed-set, and reduced reproduction. If the disturbance is severe, mortality of individuals or populations can occur. Impacts to individual plants can negatively affect growth and development, population size, and species' viability across a landscape. For annual plant species, the timing of impacts is critical. Management actions that are implemented subsequent to seed-set have less effect than management actions conducted prior to seed-set, as the seeds may still have an opportunity to germinate in the future.

Indirect effects on sensitive species or their potential habitat are effects that are separated from an action in either time or space. Indirect effects resulting from project implementation may affect the quantity, quality, and distribution of habitats and may have positive or negative effects on sensitive plant populations. Artificial regeneration, hand release of competing vegetation, and road construction can indirectly impact sensitive plants by altering vegetation composition and successional pathways of vegetation and/or changing local hydrologic patterns or soil characteristics in sensitive plant habitats. New human use patterns can result in different potential impacts to sensitive species. Indirect effects can also occur from noxious weed invasion or from impacts to pollinators or mycorrhizae associated with sensitive plant species. Indirect effects being considered in this discussion include impacts on sensitive plant species and their habitats as a result of project implementation. Indirect effects include: potential noxious weed invasions, changes in vegetation composition, loss of suitable sensitive plant habitat, change of hydrologic patterns of sensitive plants, and change in soil characteristics of sensitive plant habitats.

Alternative 1 (No Action)

Direct Effects: Alternative 1 calls for "no action" within the total project area. There would be no implementation or activities within the project area therefore there would be no direct effects resulting from this alternative.

Indirect Effects: The following species may experience indirect effects from Alternative 1:

Arabis rigidissima var. *demota* (Galena Creek rock cress), *Botrychium acendens* (upswept moonwort), *Botrychium crenulatum* (scalloped moonwort), *Botrychium lineare* (slender moonwort), *Botrychium lunaria* (common moonwort), *Botrychium minganense* (Mingan moonwort), *Botrychium montanum* (western goblin), *Bruchia bolanderi* (Bolander's candle moss), *Epilobium howellii* (subalpine fireweed), *Erigeron miser* (starved daisy), *Eriogonum umbellatum* var. *torreyanum* (Donner Pass buckwheat), *Helodium blandowii*, (Blandow's bog-moss), *Hulsea brevifolia* (short-leaved hulsea), *Lewisia kelloggii* ssp. *hutchisonii* and *L. kelloggii* ssp *kelloggii* (Kellogg's lewisia), *Meesia triquetra* (three-ranked hump-moss), *Meesia uliginosa* (broad-nerved hump-moss), *Peltigera hydrothyria* (veined water lichen).

Indirect effects may occur as a result of the No Action alternative within the proposed project area. There would be an increase in fuel loading across the landscape. This would be facilitated by a natural progression over time including increased growth of trees, additional dead trees, additional dead and downed fuels, and an increase of ladder fuels. There may be an increase of conifer encroachment into meadows and riparian ecosystems. The potential increase in tree and shrub density across the landscape may decrease available water for riparian plant species. Sensitive plants found within riparian and mesic meadow ecosystems may be impacted through habitat loss resulting from decreased soil moisture. The increased fuel loading and overstory growth would add to a shading of understory layers. This would alter the plant communities and structure. There may also be an increase in growth and density of the existing shrub layer across the landscape. All these combined factors can result in the loss of potential habitat for all listed sensitive species with suitable habitat within the project area by decreasing the amount of available suitable acreage. This may occur in forest, meadow, riparian, and shrub dominated areas.

Another indirect effect of the “no action” alternative can be an increase in the risk for catastrophic wildland fire and extreme fire behavior across the landscape. This is due to the excessive fuel loading that exists presently within the project area in addition to a projected increase in fuel loading. If a catastrophic wildland fire occurs, there may be adverse impacts to sensitive plant occurrences, suitable habitat, sensitive plant communities, and mycorrhizae- dependent plant communities. This potential impact would entail a loss of suitable habitat, a loss of occupied habitat, a loss of individuals, and the introduction and spread of noxious weeds.

No LTBMU sensitive plants life cycles, establishment, or regeneration are known to be dependant on catastrophic fire. Sensitive plant occurrences and suitable habitat may be impacted by burning individuals or modifying suitable habitat into unsuitable habitat. Mycorrhizal mats existing in organic soils may be burnt, impacting branched collybia and moonwort species habitat dependent on organic soils containing healthy mycorrhizae.

The disturbance that wildland fire can create opens pathways for new noxious weed invasions and a spread of existing infestations. Noxious weed invasion can result in negative impacts to all ecosystems, although different habitats may be invaded by different noxious weed species. Noxious weed infestations can lead to changes in habitat characteristics that are detrimental to sensitive plant species. Once weeds have become established they can indirectly impact sensitive species through allelopathy (the production and release of chemical compounds that inhibit the growth of other plants), altering fire regimes, and competing for nutrients, light, and water. Because noxious weeds can be difficult to control or eradicate, weed control efforts that must be conducted on a regular basis, such as hand-pulling or digging, could also negatively impact sensitive plants and suitable habitat.

Alternatives 2 and 3 (Action Alternatives)

Effects of project activities are similar for both action alternatives, therefore they will be discussed together in order to avoid repetition. This also allows any differences between the action alternatives to be described for a clear comparison. The direct and indirect effects of project activates on botanical resources in general are described first followed by species specific effects. Cumulative effects will be described last.

Direct effects: Construction of temporary roads effects within suitable sensitive plant habitat include ground disturbance, the removal of trees, shrubs, and herbaceous plants, soil compaction, and the creation of open disturbed areas. The creation of landings effects within suitable sensitive plant habitat include ground disturbance and soil compaction, the removal of tree, shrubs, and herbaceous plants. Landings will create or may enlarge disturbed openings within the forested stands.

Effects of hand thinning for fuel reduction and thinning within suitable sensitive plant habitat include crushing, killing, or injuring herbaceous and non vascular plants (which can reduce growth or seed production), felling and removing overstory trees reducing the canopy cover, removing or killing understory shrubs reducing the shrub cover, removal of coarse woody debris, accumulation of slash dispersed on the ground, the creation of burn piles, reduction of the ground litter layer, ground disturbance, soil disturbance, soil compaction, and the creation of open disturbed areas. Stand tree density and shading of the understory would be reduced.

Direct effects from mechanical fuel reduction and thinning within suitable sensitive plant habitat include the same direct effects as hand thinning: crushing, killing, or injuring herbaceous and non vascular plants (which can reduce growth or seed production), felling and removing overstory trees reducing the canopy cover, removing or killing understory shrubs reducing the shrub cover, removal of coarse woody debris, accumulation of slash and wood chips dispersed on the ground, the creation of wood piles, reduction of the ground litter layer, ground disturbance, soil disturbance, soil compaction, and the creation of open disturbed areas. Stand tree density and shading of the understory would be reduced. Additional mechanical fuel reduction and thinning direct effects include: creation of skid trails and driving over plants killing or uprooting them and disturbance of mycorrhizal soils caused from mechanized and motorized equipment moving throughout the project area.

Direct effects from prescribed fire and underburning within suitable sensitive plant habitat include killing trees, shrubs, and herbaceous plants and creating open disturbed areas. Mycorrhizal soils may be impacted depending on the intensity of the prescribed fire or underburn.

Indirect effects: Effects from the creation of temporary roads and landings within suitable sensitive plant habitat include altering plant communities, changing vegetation composition and successional pathways, impacts to soils and mycorrhizal soils of sensitive plants, and the potential for noxious weed invasion or spread.

Effects of hand thinning for fuel reduction and thinning within suitable sensitive plant habitat include altering plant communities, changing vegetation composition and successional pathways, impacts to soils and mycorrhizal soils of sensitive plants, and the potential for noxious weed invasion or spread.

Indirect effects of mechanical methods of fuel reduction and thinning within suitable sensitive plant habitat include altering plant communities, changing vegetation composition and successional pathways, impacts to soils and mycorrhizal soils of sensitive plants, impacts to hydrology of sensitive plant communities, and the potential for noxious weed invasion or spread.

Indirect effects from prescribed fire and underburning within suitable sensitive plant habitat include altering plant communities, changing vegetation composition and successional pathways, impacts to soils and mycorrhizal soils of sensitive plants, and the potential for noxious weed invasion or spread.

Indirect effects to fens, wetlands, wet meadows, and riparian areas within suitable sensitive plant habitat include altering hydrology, flow patterns, and water regimes which affect sensitive plants and sensitive plant communities. Design criteria have been developed to eliminate adverse effects from mechanical treatment utilizing motorized vehicles such as open disturbed areas, ruts and soil disturbance which can lead to altered hydrology, drying out of soils, change in species composition and plant communities, and the loss of sensitive plant habitat and sensitive plants. (Chapter 2, Sensitive Plant BE Appendix B).

Although suitable habitats may be directly altered initially, there may be long term beneficial indirect effects from the South Shore project. The activities under both action alternatives may enhance and increase available sensitive plant suitable habitat by changing the present condition to a more desirable condition. This may include an increase of available water in the soils and riparian areas and the reduction of canopy cover of trees and shrubs, along with a reduction in the risk of high-intensity wildfire.

Beneficial indirect effects to fens, wetlands, wet meadows, and riparian areas can result from hand or mechanical fuel reduction and thinning which may enhance and increase suitable sensitive plant habitat. Cutting trees reduces the evapotransporation rates around fens, wetlands, wet meadows, and riparian areas which can increase available ground and runoff water to the ecosystems over the longer growing season. Reducing the overstory through fuel reduction and thinning also creates openings with less shading which can promote more evaporation of wetlands to reduce water levels early in the growing season.

Organic soils are included in the factors that regulate the health and productivity of forests. Fuels reduction, thinning, and prescribed burning may reduce the amount of soil surface organic matter, which. could reduce mycorrhizae development. Moonwort complex species and branched collybia are dependent on soil mycorrhizae for establishment and growth. Reduction in mycorrhizae in these soils can cause indirect effects to these sensitive plant species, including: compromised vegetative and reproductive growth, loss of individuals, and loss of suitable habitat. Studies have correlated mycorrhizae reduction and reduced tree growth to the removal of organic soil horizons and high levels of soil disturbance. Removal of large coarse woody debris through fuels reduction and thinning also may have unknown impacts on soil health and productivity (Jurgensen, Harvey, et al 1997).

There is potential for indirect effects from noxious weeds to sensitive plant species and their habitats from noxious weed invasions as a result of project implementation. Noxious weed invasion can result in negative impacts to all ecosystems, although different habitats may be invaded by different noxious weed species. Noxious weed infestations can lead to changes in habitat that are detrimental to sensitive plant species. Once weeds have become established they can indirectly impact sensitive species through allelopathy (the production and release of chemical compounds that inhibit the growth of other plants), altering fire regimes, and competing for nutrients, light, and water. Weed control efforts that must be conducted on a regular basis, such as hand-pulling or digging, could also negatively impact sensitive plants. Standard management practices would be required to minimize the threat from noxious weed establishment and infestation. (See Chapter 2 for weed prevention design features.

Species specific effects

***Arabis rigidissima* var. *demota* (Galena Creek rock cress):** Galena Creek rock cress is designated as sensitive by the regional forester in regions 4 and 5. Galena Creek rock cress is a perennial herb with 1 to many stems growing from a woody base that is usually branched. Habitat includes open, rocky areas along forest edges of conifer and/or aspen stands typically on northerly aspects above 7,500 ft. Galena Creek rockcress is a geographically restricted regional endemic that is known from the Carson Range of the Sierra Nevada in southern Washoe County and Douglas County, Nevada and from the Martis Peak area in Placer County and Eldorado County California. Galena Creek rock cress was not located during project surveys and has no suitable habitat in any stands that have not been surveyed. There would be no direct, indirect, or cumulative effects to Galena Creek rock cress from the proposed project.

Botrychium species, moonwort complex include:

Botrychium acendens, upswept moonwort
Botrychium crenulatum, scalloped moonwort
Botrychium lineare, slender moonwort
Botrychium lunaria, common moonwort
Botrychium minganense, Mingan moonwort
Botrychium montanum, western goblin

Moonworts are perennial herbs. They are very small, thin, delicate, primitive ferns, typically less than 5 in tall. Literature suggests species in the moonwort complex share similar preferences in habitat, such as wet or moist soils in marshes, meadows, and along the edges of lakes and streams at elevations between 4,700 and 9,000 ft. They grow with mosses, grasses, sedges, rushes, and other riparian vegetation and are closely associated with mycorrhizal fungi at all life stages. The moonworts are sensitive to drought and may be dormant in dry years. Important habitat requirements are shade and soil moisture, presence of organic matter, and avoiding disturbance such as defoliation or root/mycorrhizal disruption. Potential habitat for moonwort species is found in riparian zones and seeps in the proposed project. This includes wet or moist soils in marshes, meadows, and along the edges of lakes and streams. There are approximately 2059 acres of potential moonwort complex (*Botrychium spp.)* habitat within the total project area.

There are no known sites of slender moonwort, or common moonwort on the LTBMU. There are two documented occurrences of scalloped moonwort in the Lake Tahoe Basin; one is on California Tahoe Conservancy property in Ward Canyon at an elevation of approximately 6,400 ft with 36 individuals, and the other is on the LTBMU in Blackwood Canyon at the same elevation with 2 individuals. Both sites are on volcanic soils. There is one documented occurrence of Mingan moonwort, consisting of two individuals, on the east shore of Lake Tahoe within a riparian zone. One occurrence of western goblin, consisting of 34 individuals, was found and confirmed in 2006 near Meeks Meadow in a seep adjacent to a hiking trail. There is one occurrence of upswept moonwort in the South Shore project area which was found during project surveys conducted in 2007. Following are the individual moonwort species findings:

***Botrychium acendens* (upswept moonwort):** Upswept moonwort is designated as sensitive by the regional forester. This species is often found in wet meadows or in riparian areas in coniferous forests and is currently known from 1500-2285 meters. Four individuals were identified in a small seep area below alders (*Alnus incana*) within a mixed conifer forest. Moonworts and their roots are dependent on mycorrhizal soils. Any impacts or loss of these organic soils can lead to loss of habitat, individuals, or occurrences. No fuels reduction or thinning activities would occur near the upswept moonwort population or associated organic mycorrhizal soils. This area is designated for hand thinning. Trees would be directionally felled away from the population and buffered area. Prescribed fire or underburning would not be allowed within the population vicinity. If any new populations are found they would be protected, avoided, and upswept moonwort design criteria would be applied. There would be no direct effects to upswept moonwort from the proposed project.

Due to years of fire suppression the natural fire regime and fire return interval across the LTBMU landscape has been altered. This has promoted an increased fuel loading, increased tree density, and increased overstory shading. This ecosystem dynamic may have resulted in a loss or decreased quality of suitable upswept moonwort habitat through loss of available ground moisture and decreased suitable riparian habitat.

The proposed project may yield beneficial indirect effects to upswept moonwort. Fuel reduction and hand thinning project activities would reduce the basal area, density, and overstory shading of conifers throughout the stand. Although there may be initial disturbance from fuel reduction activities outside of the existing upswept moonwort buffered area, a healthier stand ecosystem would result in the long term. This would increase available moisture and nutrients within the stand, enhancing the small stream/seep where the population exists. There is also the possibility of negative indirect effects resulting from the spread of noxious weed spread from the implementation of the proposed project.

Cumulative effects to upswept moonwort include past, present, and foreseeable future actions are bounded by the LTBMU Bijou Frontage HUC7 watershed where upswept moonwort is found in the South Shore project area. This bounding was chosen because there is only one occurrence of upswept moonwort on the LTBMU. Although *Botrychium spp.* reproduce through underground rhizomes with associated mycorrhizae and organic soils, they also have sporophores which produce viable spores for reproduction. Because of the ability of moonwort gametophytes to self-fertilize, it is reasonable to expect that a single spore is capable of dispersing and establishing a new population. However, these spores have highly specific germination requirements and some researchers have hypothesized that the average dispersal distance for some *Botrychium spp.* ranges from a few centimeters up to three meters. Establishment of new populations outside the vicinity of the project area from the existing upswept moonwort population is low. Therefore past, present, and foreseeable future actions would only have potential or incremental cumulative effects to the one isolated occurrence found within the project boundary.

Past and Present actions and projects in the upswept moonwort area include recreation activities and fuels reduction projects:

- Hand thinning 1997-2006 (200 acres)
- Mechanical thinning 1988 and 2004 (297 acres)
- Pile burning 1989, 2004, 2006, and 2007 (236 acres)
- Mastication/Chipping/Rearrangement of Activity Fuels/Lop and Scatter 2004, 2005, 2006 (81 acres)

Reasonably foreseeable future actions in the upswept moonwort area include human use and recreation. These would not increase as a direct result of this project but is expected to increase over time as population centers near the lake continue to grow

Current management direction is designed to eliminate or reduce possible negative cumulative impacts by protecting known sensitive plants species from direct and indirect impacts. Overall, management of the direct and indirect effects through project design criteria and implementation of appropriate recommendation measures would minimize the potential for negative cumulative effects. However, indirect effects could potentially occur due to invasion of noxious weeds. The recommended weed mitigation measures would be followed from the noxious weed risk assessment and the risk to spread weeds is low, however, these are not 100% effective. Because indirect effects exist due to the low risk spread of noxious weeds, there could be minimal cumulative effects as a result of this project.

***Botrychium crenulatum* (scalloped moonwort), *Botrychium lineare* (slender moonwort), *Botrychium lunaria* (common moonwort), *Botrychium minganense* (Mingan moonwort), and *Botrychium montanum* (western goblin)**: There would be no direct, indirect, or cumulative effects to scalloped moonwort, slender moonwort, common moonwort, Mingan moonwort, or western goblin from the proposed project. Scalloped moonwort, slender moonwort, common moonwort, Mingan moonwort, or western goblin were not located during project surveys. Sensitive plant and floristic surveys were conducted in suitable habitat during the 2006 - 2008 field seasons by LTBMU botanists.

***Bruchia bolanderi* (Bolander's candle moss):** There would be no direct, indirect, or cumulative effects to Bolander's candle moss from the proposed project. Bolander's candle moss was not located during project surveys.

***Dendrocollybia racemosa* (branched collybia):** There would be no direct, indirect, or cumulative effects to branched collybia from the proposed project. Branched collybia was not located during project surveys. However, in 2008, permanent Region 5 branched collybia monitoring plots were established within the South Shore project area. Regional habitat modeling determined that branched collybia potential is highest for LTBMU within these plots. Design criteria have been developed to prevent direct impact or degradation to branched collybia monitoring plots, including avoidance, buffering, and retaining shrub species integral to ectomycorrhizae (See Appendix C of the sensitive plant BE, design criteria for branched collybia,).

***Epilobium howellii* (subalpine fireweed):** There would be no direct, indirect, or cumulative effects to subalpine fireweed from the proposed project. Subalpine fireweed was not located during project surveys.

***Eriogonum umbellatum* var. *torreyanum* (Donner Pass buckwheat):** There would be no direct, indirect, or cumulative effects to Donner Pass buckwheat from the proposed project. Donner Pass buckwheat was not located during project surveys.

***Helodium blandowii*, (Blandow's bog-moss):** There would be no direct, indirect, or cumulative effects to Blandow's bog-moss from the proposed project. Blandow's bog-moss was not located during project surveys.

***Hulsea brevifolia* (short-leaved hulsea):** There would be no direct, indirect, or cumulative effects to short-leaved hulsea from the proposed project. Short-leaved hulsea was not located during project surveys.

***Lewisia kelloggii* ssp. *hutchisonii* and *L. kelloggii* ssp *kelloggii* (Kellogg's lewisia):** There would be no direct, indirect, or cumulative effects to Kellogg's lewisia from the proposed project. Kellogg's lewisia was not located during project surveys.

***Meesia triquetra* (three-ranked hump-moss):** There would be no direct effects to three-ranked hump-moss from the proposed project. Two populations of three-ranked hump-moss exist within the footprint of the proposed project known from prior to project surveys, one of which is in a fen. There is also a large population of three-ranked hump-moss in the Grass Lake research natural area (Map 21) which is located adjacent, but outside of, the South Shore project footprint. Project surveys did not locate any additional populations. Design criteria would eliminate any direct impacts to three-ranked hump-moss.

No project activities would be allowed within a buffered area of the three-ranked hump-moss populations. In addition, no project activities would be conducted in any adjacent fen, wet, or saturated soils to keep from impacting the hydrology required by the sensitive moss. Directional felling of trees would occur away from any wet soils. Underburning would not occur within the buffered area near the population or surrounding wet soils. Hand thinning rather than mechanical thinning would occur in the areas adjacent to the buffered areas to ensure that no impacts to the habitat hydrology would occur due to heavy machinery.

There will be no project activities within Grass Lake RNA. The project activities will be restricted to ingress and egress along the access road which borders the RNA. There will be no disturbance or impacts to the RNA or sensitive plant communities within the RNA.

However, there may be some beneficial indirect effects from the proposed action to three-ranked hump-moss. Cutting trees reduces the evapotransporation rates around fens, wetlands, wet meadows, and riparian areas. This can increase available ground and runoff water to these ecosystems. An increase in available water can increase the size and health of both fen and riparian areas populated by three-ranked hump-moss.

The following are the past, present, and foreseeable future actions that have affected or may affect broad-nerved hump moss in the South Shore DEIS project area. Past, present, and foreseeable future actions are bounded where broad-nerved hump moss is found in the vicinity of the South Shore DEIS area. This includes project footprint, Grass Lake RNA, and an occurrence of three-ranked hump-moss near the proposed project footprint which is located 600 meters from a treatment unit. This bounding was chosen because all of the occurrences of the species are within the near vicinity of the project area.

Past and present actions and projects in the three-ranked hump-moss bounded area include:

Angora Creek restoration [sewer reach (constructed 2002), golf course reach (constructed 1997-98), above View Circle and low water crossing replacement (constructed 2005 and 2006)]

- In Angora Creek HUC7: Approx. 8,000 ft of restored stream length from sewer reach and golf course reach combined; 2,300 ft of restored channel and 4.5 acres of SEZ enhancement from the project above View Circle
- Creation of Grass Lake Research Natural Area (RNA)
- Previous fuel reduction projects near Saxon Creek
- Hand thinning 1999-2007 (512 acres)
- Mechanical thinning 1998-2002 (479 acres)
- Pile burning 2001-2005 (457 acres)
- Mastication/Chipping/Rearrangement of Activity Fuels/Lop and Scatter 2001, 2002, 2007 (252 acres)
- Recreation

Future actions and projects in the three-ranked hump-moss bounded area include:

- Lake Tahoe ecosystem underburn project
- Angora Fire ecosystem restoration project
- Angora hazard tree removal project
- Aspen community restoration project
- Upper Truckee River – Sunset Reach (planned 2009-2011 construction)
- Lower Upper Truckee HUC7 – expected length of restored channel is 12,000 ft

Current management direction is designed to eliminate or reduce possible negative cumulative impacts by protecting known sensitive plants species from direct and indirect impacts. Overall, management of the direct and indirect effects through project design criteria and implementation of those design criteria would minimize the potential for negative cumulative effects. Because there would be no adverse direct or indirect effects there would be no negative cumulative effects to three-ranked hump-moss as a result of the South Shore project.

Meesia uliginosa **(broad-nerved hump-moss):** Two populations of broad-nerved hump-moss known from prior surveys exist within the footprint of the South Shore project. Project surveys did not locate any additional populations. Design criteria have been developed to eliminate any direct impacts and adverse indirect impacts to broad-nerved hump-moss. There would be no direct effects to broad-nerved hump-moss from the proposed project.

One of these populations is located in a unit that would be hand thinned. No project activities would be conducted within a buffered area around the broad-nerved hump-moss population or in wet or saturated soils to avoid impacting the hydrology required by this sensitive moss. Directional felling of trees would occur away from any wet soils and underburning would not occur near the sensitive moss population or wet soils.

The other population is located in a fen within in a unit would be mechanically thinned. The fen would be flagged and buffered. No project activities will occur within the fen or buffer which support the hydrology of the fen. Hand thinning rather than mechanical thinning will occur in the areas adjacent to the buffered area to ensure that no impacts to the fen hydrology due to heavy machinery will occur. No underburning will occur within buffered areas.

Design criteria will also ensure that there would be no adverse indirect effects to the broad-nerved hump-moss from the proposed project. However, there may be some beneficial indirect effects from the proposed action to broad-nerved hump-moss. Removing trees reduces the evapotransporation rates around fens, wetlands, wet meadows, and riparian areas. This can increase available ground and runoff water to the ecosystems. An increase in available water can increase the size and health of both populated fen and riparian areas in the South Shore project.

The following are the past, present, and foreseeable future actions that have affected or may affect broad-nerved hump moss in the South Shore project area. Past, present, and foreseeable future actions are bounded where broad-nerved hump moss is found in the vicinity of the South Shore Fuels Reduction and Healthy Forest Restoration Project. This bounding was chosen because it contains the only occupied habitat of broad-nerved hump moss within the Lake Tahoe Basin.

Past and Present actions and projects in the broad-nerved hump-moss bounded area include:

- Angora Creek Restoration [sewer reach (constructed 2002), golf course reach (constructed 1997-98), above View Circle, and low water crossing replacement (constructed 2005 and 2006)]
- Angora Creek HUC7: Approx. 8,000 ft of restored stream length from sewer reach and golf course reach combined; 2,300 ft of restored channel and 4.5 acres of SEZ enhancement from the project above View Circle
- Upper Truckee River – Sunset Reach (planned 2009-2011 construction)
- Lower Upper Truckee HUC7 - Expected length of restored channel is 12,000 ft

Future actions and projects in the broad-nerved hump-moss bounded area include:

- Upper Truckee River – Sunset Reach (planned 2009-2011 construction)
- Lower Upper Truckee HUC - Expected length of restored channel is 12,000 ft

Current management direction is designed to eliminate or reduce possible negative cumulative impacts by protecting known sensitive plants species from direct and indirect impacts. Overall, management of the direct and indirect effects through project design criteria and implementation of the project design features will minimize the potential for negative cumulative effects. Because there will be no adverse direct or indirect effects, there will be no negative cumulative effects as a result of the South Shore project.

***Peltigera hydrothyria* (veined water lichen):** Suitable habitat exists in cold unpolluted streams. Veined water lichen was not located during project surveys. There will be no direct, indirect, or cumulative effects to veined water lichen from the proposed project.

***Rorippa subumbellata* (Tahoe yellow cress):** Tahoe yellow cress is designated as a candidate species for listing as threatened or endangered under the ESA, sensitive by the regional forester, and a special interest species by TRPA. Tahoe yellow cress is a Lake Tahoe endemic species, found only along the Lake Tahoe shoreline and beaches in both California and Nevada. In 1999, the U.S. Fish and Wildlife Service recognized Tahoe yellow cress as a Candidate species for listing under the Endangered Species Act of 1973, as amended.

There are 62 occurrences of Tahoe yellow cress in the Lake Tahoe Basin. Tahoe yellow cress has been managed over the long-term as Forest Service Sensitive, and various actions have been taken to ensure its protection on lands managed by the LTBMU and other public agencies. Most recently, a conservation strategy was developed and signed by 13 partners around Lake Tahoe. The strategy outlines management and conservation goals and objectives necessary to ensure the long-term survival of the species.

Tahoe yellow cress is a somewhat fleshy perennial herb that grows close to the ground. The rootstocks tend to grow horizontal and are slender and branched; which allows the plant to form large clumps of clones. The small yellow four-petaled flowers are found in flat or elongated clusters at the ends of the branches. The plant flowers in May-September and typically occupies sandy substrates composed of course to medium-sized grains of decomposing granite on the shores of Lake Tahoe between the elevations of 6,223 and 6,230 feet. The species is sometimes associated with stream mouths and backshore areas in very dynamic environments to which the species is well adapted. The number of Tahoe yellow cress stems fluctuates over time as the level of Lake Tahoe changes due to precipitation and dam operations. As few as 10 stems and as many as 30,000 stems have been estimated, and the number of occupied sites also changes with lake level. Some sites become inundated as lake level rises, while other sites that occur above the maximum lake elevation tend to be persistent over time. As few as 7 sites have been documented during high lake conditions.

The species is threatened by human activities in the shorezone, especially when the lake level is high. Recreation, along with development and maintenance of marinas, piers, boat ramps, and other recreational facilities within the shorezone impact this species and its habitat. When the lake level is high, beach users are heavily concentrated in areas occupied by the species, which results in trampling of individual plants as well as habitat disturbance.

Tahoe yellow cress does not exist within the footprint of the proposed project. However, there is a core population within the vicinity of the project area. Design criteria have been developed to eliminate potential impacts to this sensitive plant species. No operations would be allowed within 300 feet of critical Tahoe yellow cress habitat. This insures that no individuals or potential habitat would receive direct effects from the proposed project. Design criteria would also ensure that there will be no direct or indirect effects to the ecological processes of Taylor Creek which is the driving dynamic ecological force responsible for this core population. No underburning or prescribed fire will occur near Tahoe yellow cress populations. There will be no direct or indirect effects to Tahoe yellow cress resulting from the proposed project.

The following are the past, present, and foreseeable future actions that have affected or may affect Tahoe yellow cress in the South Shore project area. Past, present, and foreseeable future actions are bounded by habitat where Tahoe yellow cress is found in the vicinity of the South Shore project. This bounding was chosen because Tahoe yellow cress only occurs on beach habitat around Lake Tahoe. For this reason the past, present, and foreseeable future actions are most important along the beach habitat where this species occurs near the footprint of the proposed project.

Past and Present actions and projects in the Tahoe yellow cress bounded area include:

- Establishment of public beaches, boat launches, private homes, and structures
- Visitor use and recreation on the public beaches
- Water intake line construction
- Pier construction

Future actions and projects in the Tahoe yellow cress bounded area:

- Human use will not increase as a direct result of this project but is expected to increase over time as population centers near the lake continue to grow.
- Increased visitor use and recreation on the public beaches where Tahoe yellow cress populations and habitat exist
- Valhalla Pier accessibility retrofit project
- Upper Truckee River – marsh reach (planned 2011/2012 construction)
- Lower Upper Truckee HUC7 – propose to restore approximately 9,000 ft of channel

Past, present, and future actions may have a negative affect on Tahoe yellow cress populations and habitat. Visitor use and recreation have crushed plants, caused ground disturbance, altered beach habitat, and possibly changed plant species composition. Construction of piers have caused ground disturbance, altered potential beach habitat, may have compromised potential seed banks, and may have impacted individuals.

The Tahoe yellow cress population within the vicinity of the project area is an important core population in the Tahoe yellow cress occurrences around Lake Tahoe. Current management direction is designed to eliminate or reduce possible negative cumulative impacts by protecting known sensitive plants species from direct and indirect impacts. Overall, management of the direct and indirect effects through project design criteria and implementation of appropriate recommendation measures will minimize the potential for negative cumulative effects. Because there are no direct or indirect effects there will be no cumulative effects as a result of the South Shore project.

Cumulative Impacts

A cumulative effect results from the incremental effect of the action when added to the effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions and regardless of land ownership on which the other actions occur. Reasonably foreseeable future actions include those that are in any stage of project planning and those for which decisions have been made and are awaiting implementation. Cumulative effects are usually stated in terms of spatial (e.g. grazing, mining, and the proposed activity overlap in the same area of habitat) and temporal effects (e.g. changes in habitat over time from the past to the present to the future with and without the proposed activity).

Alternative 1 (No Action)

Under the No Action alternative, past, present, and future actions may have an indirect negative affect on sensitive plant populations and habitat. Impacts from catastrophic fires or invading noxious weeds can be compounded when plants are already at risk from such activities as changing hydrologic regimes in fen habitats, trampling by recreationists, or sedimentation buildup from eroding landscapes.

Alternative 2 (Proposed Action) and Alternative 3

Cumulative effects are similar for both action alternatives, because the design features of both action alternatives remain the same. As is discussed above for individual species, these design criteria would prevent adverse direct effects, however, there may be negative indirect effects from implementation of either action alternative. Because there may be minimal adverse indirect effects, there may be minimal cumulative effects to these species and their habitats.

Determination Of Effects

The determinations follow the guidelines and definitions established by the Pacific Southwest Region of the Forest Service (USDA FS 1996 and USDA FS 2000) for sensitive species and are described previously. Based on the description of the South Shore project and the evaluation of effects, the LTMBU botanist has determined the following:

For all three alternatives, there would be no effect to *Rorippa subumbellata* (Tahoe yellow cress) or any other plant species listed as threatened, endangered, proposed for listing, or candidates under the Endangered Species Act of 1973, as amended (ESA), administered by the U.S. Fish and Wildlife Service (USFWS). This determination is based on the absence of suitable habitat within the footprint of the proposed project for this species.

For all three alternatives, there would be no effect to the following sensitive species:

Arabis tiehmii (Tiehm's rock cress)
Draba asterophora var. *asterophora* (Tahoe draba)
Draba asterophora var. *macrocarpa* (Cup Lake draba)
Lewisia longipetala (Long-petaled lewisia).

This determination is based on the absence of suitable habitat within the project areas and the absence of individuals known or expected to occur.

For all three alternatives the project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the following species:

Botrychium ascendens (upswept moonwort)
Meesia triquetra (three-ranked hump-moss)
Meesia uliginosa (broad-nerved hump-moss).

These species are known from the project area. Design criteria have been incorporated to the South Shore DEIS that will eliminate adverse effects to these species. However, these species may be affected during project implementation if undetected individuals or populations are present but were not detected within the project area where suitable habitat occurs.

For all three alternatives the project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the following species with suitable habitat within the proposed project footprint:

Arabis rigidissima var. *demota* (Galena Creek rock cress)
Botrychium crenulatum (Scalloped moonwort)
Botrychium lineare (Slender moonwort)
Botrychium lunaria (Common moonwort)
Botrychium minganense (Mingan moonwort)
Botrychium montanum (Western goblin)
*Bruchia bolanderi (*Bolander's candle moss)
Dendrocollybia racemosa (branched collybia)
Epilobium howellii (Subalpine fireweed)
Erigeron miser (Starved daisy)
Eriogonum umbellatum var. torreyanum (Donner Pass buckwheat)
Helodium blandowii, (Blandow's bog-moss)
Hulsea brevifolia (short-leaved hulsea)
Lewisia kelloggii ssp kelloggii (Kellogg's lewisia)
Lewisia kelloggii ssp. hutchisonii
Peltigera hydrothyria (Veined water lichen)

These species may be affected during project implementation if undetected individuals or populations are present but were not detected within the project area where suitable habitat occurs.

J. Noxious Weeds

Scope of the Analysis, Indicators, and Issues

Species considered are based on the Lake Tahoe Basin weed coordinating group priorities for invasive weeds of concern, the California Department of Food and Agriculture noxious weed list, and the Nevada Department of Agriculture noxious weed list. These lists are the most current versions for the LTMBU. All applicable standards and guidelines from the LTBMU LRMP (USDA FS 1988) and associated amendments (USDA FS 2004), and other applicable laws and regulations will be applied to this project.

The scope of analysis for noxious weed existing conditions and effects for the South Shore project is defined as the area where the vegetation treatments would occur under the action alternatives, or adjacent to vegetation treatment areas, because that is the area of potential direct, indirect and cumulative effects. Indicators of implementation of the design criteria for the action alternatives would be that the flagged weed populations remain intact throughout project activities, and any new noxious weed occurrences in project activity areas are promptly treated. The objective of the design criteria for noxious weeds given in Chapter 2 of this EIS is to prevent the spread or introduction of noxious weeds. Complete species listings and analysis details are given in the noxious weed risk assessment, located in the project file and incorporated here by reference.

Existing Conditions

In addition to known locations of noxious weeds, surveys were conducted in June, July, and August of 2005, 2006, 2007, and 2008 by Forest Service TEAMS planning enterprise crew and LTBMU botany staff (Map 18). A review of the LTBMU weed atlases and available GIS coverage was used to evaluate the extent of potential weed risk within the proposed project areas. Weed surveys conducted in the proposed project areas focus on species with potential to occur; however, attempts are made to identify all plants encountered in the field. Some species have specific areas of greater risk of occurrence, and botanists search for these as well. Species that are not found in or adjacent to the project area are not analyzed in this EIS.

Sierra Nevada Forest Plan Amendment (SNFPA) part 3.6 defines noxious weeds as: those plant species designated as noxious weeds by Federal or State law. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and generally non-native. Noxious weeds are categorized by several entities, with similar, but slightly different systems. The Lake Tahoe basin weed coordinating group (LTBWCG) prioritizes invasive weeds of concern by management group: Group 1: watch for, report, and eradicate immediately; Group 2: manage infestations with the goal of eradication.

The California Department of Food and Agriculture's (CDFA) noxious weed list (http://www.cdfa.ca.gov/phpps/ipc/) divides noxious weeds into categories A, B, C and Q. A-listed weeds are those for which eradication or containment is required at the state or county level. For B-listed weeds, eradication or containment is at the discretion of the county agricultural commissioner. C-listed weeds require eradication or containment only when found in a nursery or at the discretion of the county agricultural commissioner. Q-listed weeds require temporary "A" action pending determination of a permanent rating.

Nevada Department of Agriculture (NDA) (http://agri.nv.gov/nwac/PLANT_NoxWeedList.htm divides) divides noxious weeds into categories A, B, and C. Category "A": Weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; actively eradicated from nursery stock dealer premises; control required by the state in all infestations. Category "B": Weeds established in scattered populations in some counties of the state; actively excluded where possible, actively eradicated from nursery stock dealer premises; control required by the state in areas where populations are not well established or previously unknown to occur. Category "C": Weeds currently established and generally widespread in many counties of the state; actively eradicated from nursery stock dealer premises; abatement at the discretion of the state quarantine officer.

The following noxious weeds or their habitat are located within or in close proximity to the South Shore project treatment areas:

Table 3-118. Noxious and invasive weed species in or near the project area

Common Name	Scientific Name	LTBWCG	CDFA	NDA	SNFPA	Species Present? Y or N
Cheat grass	*Bromus tectorum*				NW	Y
Bull thistle	*Cirsium vulgare*	Group 2	C		NW	Y
Scotchbroom	*Cytisus scoparius*	Group 2	C		NW	Y
St. John's wort/ Klamath weed	*Hypericum perforatum*	Group 2	C	A	NW	Y
Tall whitetop/ Perennial pepperweed	*Lepidium latifolium*	Group 2	B	C	NW	Y
Ox eye daisy	*Leucanthemum vulgare*	Group 2			NW	Y
Dalmatian toadflax	*Linaria genistifolia spp. dalmatica*	Group 2	A	A	NW	Y
Eurasian watermilfoil	*Myriophyllum spicatum*	Group 2	C	A	NW	Y
Sulfur cinquefoil	*Potentilla recta*	Group 1	Q	A		Y
Spiny Sowthistle	*Sonchus asper.*		A	A		Y
Woolly mullein	*Verbascum thapsus*				NW	Y

Noxious weeds are well-adapted to colonize disturbed sites, and the existing noxious weed infestations in the project area can be spread by the same types of activities that provided sites for the existing weed populations. The vectors to spread or introduce noxious weeds include:

- Vehicle traffic flow through the project area.
- Recreation us, including use of foot and bicycle trails.
- Livestock, or pack stock movements and wildlife migrations.
- Wind patterns and drainage flow direction.

Noxious weed invasion can result in negative impacts to all ecosystems, although different habitats may be invaded by different noxious weed species. Noxious weed infestations can lead to changes in habitat characteristics that are detrimental to other plant species and wildlife. Once weeds have become established they can indirectly impact other species through the production and release of chemical compounds that inhibit the growth of other plants, altering fire regimes, and competing for nutrients, light, and water. Because noxious weeds can be difficult to control or eradicate, weed control efforts that must be conducted on a regular basis, such as hand-pulling or digging, can also negatively impact other plants, habitats, and soils.

Direct and Indirect Environmental Consequences

Noxious weed invasion would be an indirect effect of South Shore project implementation. While ground-disturbing activities may provide sites for noxious weed establishment, objectives and design features of the project are to prevent noxious weed invasion.

Alternative 1 (No Action)

Alternative 1 calls for "No Action" within the total project area. There would be no implementation or activities within the project area therefore there would be no direct effects resulting from this alternative. An indirect effect of the "no action" alternative would be an increase in the risk for catastrophic wildland fire and extreme fire behavior across the landscape due to the fuel loading that exists presently in addition to a projected increase in fuel loading. The disturbance of wildland fire can create pathways for new noxious weed invasions and a spread of existing infestations.

Alternative 2 (Proposed Action) and Alternative 3

Alternatives 2 and 3 would have similar effects, and will be discussed together to reduce redundant text and clarify differences between the action alternatives. Both action alternatives include ground disturbance and soil compaction from thinning operations to remove trees with large machinery. There would be ground disturbance and soil compaction due to construction of landings and temporary roads, as well as reconstruction and maintenance of existing roads. Further ground disturbance could occur from either machine or hand piling and burning. Both action alternatives would increase the risk of noxious weed invasion from the creation of new disturbed and open areas. The use of vehicles and machinery increases the risk of spreading noxious weeds into new areas. Implementation of project design features would reduce the risk of spread or introduction of noxious weeds for both action alternatives. While the type of effects are the same for both action alternatives, Alternative 3 would reduce the potential for noxious weed invasion through a reduction in the acres treated, a reduction in road mileage needed, and changes from mechanical treatment methods to hand treatments as described in Chapter 2.

Cumulative Impacts

Alternative 1 (No Action)

Under the No Action alternative, the existing factors for noxious weeds would continue, as discussed above. The increased risk of high intensity wildfire would also continue. However, there would be no additive effect from project implementation, and therefore there would be no cumulative effects from Alternative 1.

Alternative 2 (Proposed Action) and Alternative 3

Cumulative effects are similar for both action alternatives, and the direct and indirect effects discussed above would add to the existing factors for noxious weeds, including vehicle traffic, recreation use of roads and trails, movement of wildlife and livestock, and the physical factors of wind and water flow patterns. The cumulative effects of Alternative 3 would be less than Alternative 2 because the acres of ground disturbance and miles of road used are both less.

K. Air Quality

Scope of the Analysis, Indicators, and Issues

The area of analysis for air quality effects is the Lake Tahoe Basin, including the project area extending through the watersheds that define the South Shore project analysis area. Air quality effects from implementation of either of the action alternatives would be expected to occur mainly within the spatial boundary of the project analysis area for two reasons: 1) because these watersheds extend beyond the treatment units to the crest of the mountains surrounding the South Shore project activities, and 2) because both vertical and horizontal mixing of air within the treatment units would reduce effects to air quality through dispersion over distance from the treatment activities. However, the effects to air quality could potentially spread further into the Lake Tahoe Basin during weather conditions that prevent dispersion. The timeframe for effects to air quality would be from the beginning of thinning operations through final prescribed fire activities, a period of approximately 7-8 years, depending on the length of time needed for project implementation and prescribed burning conditions to be met, both for fuels to be dry enough to produce a minimum amount of smoke, and for availability of approved burn days.

Regulatory Agencies

In California, air quality is managed at three levels of government: federal (EPA), state (CARB), and local (APCDs) described below:

The Environmental Protection Agency (EPA) has the primary federal role of ensuing compliance with the requirements of the Clean Air Act. EPA issues national air quality regulations, approves and oversees state implementation plans, and conducts major enforcement actions. In California, the state agency responsible for meeting the Clean Air Act requirements is the California Air Resource Board (CARB). The CARB has further delegated the authorities to local Air Districts or Air Pollution Control Districts (APCDs) or Air Quality Management Districts (AQMDs) for stationary sources, while retaining the authority for mobile sources. The districts have the primary responsibility for meeting the requirements of the Clean Air Act. This responsibility is carried out through the development and execution of implementation plans, which must provide for the attainment and maintenance of air quality standards.

<u>Federal – Clean Air Act</u>

The Clean Air Act designates as Class I, II, or III airsheds for prevention of significant deterioration purposes. Class I areas generally include national parks and wilderness areas. Class I provides the most protection to pristine lands by severely limiting the amount of additional human-caused air pollution that can be added to these areas. Desolation Wilderness is a Class I airshed. The remainder of the LTBMU is classified as a Class II airshed, where a greater amount of additional human-caused air pollution may be added. No areas on the LTBMU have been designated as Class III at this time.

The original Air Quality Act was passed in 1963. This act was followed by Clean Air Act Amendments in 1970, 1977, and 1990. The important sections under each amendment that impact agencies activities are summarized below:

Clean Air Act Amendment 1970

The Clean Air Act Amendments of 1970, Section 109, required the EPA to develop primary Ambient Air Quality Standards to protect human health and secondary standards to protect welfare.

National Ambient Air Quality Standards (NAAQS)

- To protect human health and welfare, the EPA established primary and secondary NAAQS for the following six criteria pollutants:
    - Particulate Matter (PM10, PM2.5)
    - Ozone (O3)
    - Sulfur Dioxide (SO2)
    - Nitrogen Dioxide (NO2)
    - Carbon Monoxide (CO)
    - Lead (Pb)
- The primary standards for these pollutants are shown in Tables 3-119 and 3-120 below (along with California standards).
- If federal standards are violated in any area that area is designated as "non-attainment" for that pollutant, and the state must develop a plan for bringing that area back into "attainment".
- On July16, 1997 the EPA revised Ozone 1 hour and PM^{10} standards. The revised ozone 8 hour standard and $PM^{2.5}$ standards (annual and 24 hour average) were announced.
- On December18, 2006 the EPA again revised the $PM^{2.5}$ (24 hour standard) by making it more stringent from 65 to 35 micrograms per meter cube.
- On March 12, 2008, the EPA issued a revised ozone standard. The new primary 8-hour standard is 0.075 parts per million (ppm) and the new secondary standard is set at a form and level identical to the primary standard.

Clean Air Act Amendment 1977 - Prevention of Significant Deterioration (PSD) and Air Quality Related Values (AQRVs) for Class I Areas.

- The PSD program was established in 1978 as a result of lawsuit alleging that the Clean Air Act Amendment of 1977 required that a program be established to prevent degradation of air quality in pristine areas where air quality was very high. The program requires permits for new stationary air pollution sources above a certain size. The emission from these sources may not cause deterioration of ambient air quality beyond certain increments.
- The 1977 Clean Air Act Amendments gave federal land managers an "affirmative responsibility" to protect the AQRVs of Class I areas from adverse air pollution impacts. Class I areas include national wildernesses greater than 5000 acres in existence on August 7, 1977 when the amendments were passed into law. AQRVs, as defined by Congress, include "the fundamental purposes for which Class I areas have been established and preserved by the congress and the responsible Federal Agency" (Senate Report 95-127, p36) and include visibility. AQRVs are defined as feature or properties or properties of Class I area that can be changed by air pollution. (In R5, the AQRVs, beside visibility include flora, water, soil, cultural and archaeological values and odor).
- Regional Haze: Under Regional Haze Rule, released by the EPA, each state is required to develop visibility State Implementation Plan (SIP) for Class I areas by December 31, 2007. The CARB is preparing a Regional Haze State Implementation Plan (RH SIP) for California demonstrating reasonable progress in reducing haze by 2018, the first benchmark year on the path to natural visibility by 2064. The CARB has kept the federal land managers involved in the plan development process.

Clean Air Act Amendment 1990 - Conformity

- As required under the amendment the EPA published conformity regulations for non-attainment areas in the *Federal Register* on November 30, 1993. The conformity provisions of the Clean Air Act Section 176(c) prohibit federal agencies from taking any action that:
    - Causes or contributes to any new violation of NAAQS;
    - Increases the frequency or severity of an existing violation; or
    - Delays the timely attainment of a standard in these areas
- All management activities must conform to SIP. Each federal agency is responsible for making a conformity determination for resource projects it conducts or approves. The conformity rules apply only to the activities occurring in the federal non-attainment areas.
- At present, the EPA is revising the conformity rules. The draft rules were release for public review (review closed on March 10, 2008). The new rules exempt the prescribed burn projects from conformity determination if burns are conducted under an approved smoke management program (SMP). The project emissions under de minimis level are still exempt from conformity determination. Any action subject to the conformity rule can be determined to conform if the total emissions are specifically identified and accounted for in the SIP. Additional details about conformity are given in R5 Conformity handbook (September, 2005).

Reasonably Available Control Measures (RACMs) and Best Available Control Measures (BACMs)

Section 190 of the Clean Air Act required the EPA to issue technical guidance on RACMs and BACMs for prescribed fires. RACMs and BACMs can be used as mitigation measures. Some examples of the mitigation measures include annual plans, emission inventory system, implementation of emission reduction techniques, monitoring, surveillance, and enforcement programs, local and state regulatory oversight, and public education /awareness programs etc. BACMs are required measures for non-attainment areas.

Interim Air Quality Policy

On May 15, 1998, the EPA issued “Interim Air Quality Policy on Wildland and Prescribed Fires” in response to anticipated increases in fire use that were expected to occur as a result of implementing the 1995 Fire Management and Policy Review , which outlined a need to restore fire as an ecosystem process. The interim policy was prepared in an effort to integrate the goals of allowing fire to function in an ecological role, for maintaining healthy ecosystem balance while protecting public health and welfare, by mitigating the impacts of air pollutant emissions on air quality and visibility.

The policy encourages coordination between burners and regulators. It encourages states and tribes to develop smoke management programs (SMP) for prescribed burns. Under this policy provisions the EPA will ignore a violation occurred under a certified SMP and will not designate the area non-attainment.

California has revised Title 17 in accordance with interim policy requirements and the EPA has certified it as a SMP.

The EPA is revising “interim policy” to make it consistent with the haze rule, agricultural burning and exceptional event rule.

Exceptional Event Rule

On March 10, 2006 the EPA released rules pertaining to "The Treatment of the Data Influenced by Exceptional Events". The "wildfire" and "wildfire use" is considered as an exceptional event. The EPA has proposed to implement section 319(b)(3)(B) and section 107(d)(3) authority to exclude air quality monitoring data from regulatory determination to exceedances or violation of NAAQS and avoid designating an area as a nonattainment. Also, the EPA has proposed four options with respect to whether, and to what extent, states should be required to take additional actions to address public health impacts related to the event.

State – California Clean Air Act (CCAA 1988)

The California Clean Air Act of 1988 is administered by the California Air Resource Board (CARB). The act added several requirements concerning plans and control measures to attain and maintain the state ambient air quality standards. One such requirement is for the CARB to establish designation criteria and to designate areas of the state as attainment, non-attainment or unclassified for any state standards. California has also established ambient air quality standards for sulfate, hydrogen sulfide, vinyl chloride, and visibility reducing particles. The conformity rules apply to federal actions for federal standards only.

States have direct responsibility for meeting requirements of the Federal Clean Air Act and corresponding federal regulations. As authorized by Division 26 of the California Health and Safety Code, the CARB is directly responsible for regulating emissions from mobile sources. However, authority to regulate stationary sources has been delegated to air pollution control and air quality management districts at the county and regional levels. The state still has oversight authority to monitor the performance of district programs and can even assume authority to conduct district functions if the district fails to meet its responsibilities.

State of California ambient air quality standards are goals set by the CARB to protect public health and welfare. Standards are set at levels designed to protect the most sensitive parts of the population, particularly children, the elderly, and people who suffer from lung or heart diseases. CARB performs program oversight activities, while primary air quality planning and enforcement activities are carried out by local air pollution control districts. The South Shore project area lies within the California portion of the Lake Tahoe Basin, where this program is administered by the El Dorado County Air Pollution Control District.

State Implementation Plans (SIPs)

Section 110 of the Clean Air Act requires states to develop SIPs for non-attainment areas that identify how the state will attain and maintain the NAAQS and other federal air quality regulations. How these areas will attain the standards is often based on the state's controls on new or existing air pollution sources. Controls can include more stringent pollution control requirements for industry, tighter requirements on wood- burning stoves or prescribed burning or more stringent controls on mobile sources of emissions. States and districts also have authority to make air quality standards and regulations more stringent than federal standards and regulations. The plan consists of adopted measures, commitments to adopt new measures (including adoption and implementation schedules), emission inventories, air quality modeling results, contingency measures and a demonstration of emission reductions sufficient for attainment.

The Forest Service is required to comply with all of the requirements of a SIP, once it is approved by the EPA.

Title 17

Title 17 of the California Code of Regulations Sub Chapter 2 describes the "Smoke Management Guidelines for Agricultural and Prescribed Burning" to provide direction to air pollution control and air quality management districts in the regulation and control of agricultural burning, including prescribed burning, in California. The Guidelines are intended to provide for the continuation of agricultural burning, including prescribed burning, as a resource management tool, and provide increased opportunities for prescribed burning and agricultural burning, while minimizing smoke impacts on the public. The regulatory actions called for are intended to assure that each air district has a program that meets air district and regional needs. These guidelines became effective March 14, 2001. Under the guidelines each APCD/AQMD developed a SMP that collectively was certified by the EPA as a state SMP. Under the guidelines a burn plan is developed by a burner to get a burn permit from the local APCD/AQMD. Authorization is received from the regulator on the day of burn declared by the CARB as a "burn day". BSMP elements are included in the Guidelines. Details about Title 17 can be downloaded from the site; http://www.arb.ca.gov/smp/regs/regs.htm

Local Regulators – El Dorado Air District.

The California Clean Air Act established a number of legal mandates to facilitate achieving health-based state air quality standards at the earliest practicable date. The mission statement for the El Dorado Air District correlates to the CCAA as follows:

- Compliance assistance with regulations for businesses.
- To achieve and maintain ambient air quality stands set by US EPA and California Air Resource board.
- Protect public health and the environment from adverse air quality impacts.
- Participate in public planning efforts regarding development within the District.
- Assist the public with air quality issues and education.

Regional Plan for the Lake Tahoe Air Basin

The TRPA thresholds are described in the Regional Plan, which relate to air quality or airborne emissions, as updated in the 2001 Threshold Evaluation. Chapter 72 of the TRPA Code of Ordinances contains smoke dispersal standards and regulations.

The TRPA established several environmental thresholds related to air quality. These thresholds are defined as "environmental standard[s] necessary to maintain a significant scenic, recreational, educational, scientific or natural value of the region or to maintain public health and safety within the region." The thresholds are generally expressed as regional or sub-regional environmental standards.

Both state and NAAQSs consist of two parts: an allowable concentration of a pollutant, and a time over which the pollutant concentration is to be averaged. The concentrations are based on results of studies of the effects of the pollutants on human health, crops and vegetation, and occasionally damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short period of time (1 hour, for instance), or to a relatively lower average concentration over a much longer period (1 month or 1 year). For some pollutants, there is more than one air quality standard, which reflects both its short-term and long-term effects.

Indicators to measure air quality effects are the standards for air quality under the Clean Air Act. Air quality concerns center around effect to human health, especially for sensitive groups.

Table 3-119 presents the state and NAAQSs for selected pollutants. The TRPA thresholds for the Lake Tahoe Air Basin are listed in Table 3-120. For some pollutants, TRPA does not set separate thresholds and instead uses California, Nevada, or federal standards. In those cases, the strictest threshold is listed in the table with reference to the source of that threshold.

Table 3-119. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	Nevada Standards Concentration	California Standards Concentration	Federal Standards Concentration
Ozone	8 hour 1 hour	0.10 ppm[1]	0.09 ppm	0.08 ppm[4] 0.12 ppm[5]
Carbon Monoxide	8 hour 1 hour	6.0 ppm[1] 35 ppm	6.0 ppm 2 20 ppm	9 ppm 35 ppm
Nitrogen Dioxide	Annual Average 1 hour	100 $\mu g/m^3$ (0.05 ppm)	0.25 ppm	0.053 ppm
Sulfur Dioxide	Annual Average 24 hour 3 hour 1 hour	80 $\mu g/m^3$ (0.03 ppm) 365 $\mu g/m^3$ (0.14 ppm) 1300 $\mu g/m^3$ (0.5 ppm)	0.04 ppm (105 $\mu g/m^3$) 0.25 ppm	80 $\mu g/m^3$ (0.03 ppm) 365 $\mu g/m^3$ (0.14 ppm) 1300 µg/m33 (0.5 ppm)
Suspended Particulate Matter (10 micron)	24 hour Annual Arithmetic Mean	150 $\mu g/m^3$ 50 $\mu g/m^3$	50 $\mu g/m^3$ 20 $\mu g/m^3$	150 $\mu g/m^3$ 50 $\mu g/m^3$
Suspended Particulate Matter (2.5 micron)	24 hour Annual Arithmetic Mean	----	12 $\mu g/m^3$	65 µg/m36 15.0 $\mu g/m^3$
Lead	Quarterly Average 30 Day Average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

Table 3-120. TRPA Air Quality Thresholds

Parameter	Averaging Time	Standard	Attainment Requirements
Carbon Monoxide (AQ-1)	8-hour 1-hour	6.0 ppm 20 ppm (CA)	The indicative value for attainment of this standard is the second highest CO concentration that is measured at the Stateline, CA station.
Ozone (AQ-2)	8-hour 1-hour	0.08 ppm (federal) 0.08 ppm	4th highest, 3 year average not to exceed Not to be exceeded by any monitor in the Basin
Particulate Matter-PM10 (AQ-3)	24-hour Annual	50 $\mu g/m^3$ (CA) 30 $\mu g/m^3$ (CA)	Attainment is reached if the federal or state 24hour standard is not exceeded more than once and the annual average PM^{10} concentration at is not exceeded any monitoring station.
Particular Matter – PM2.5 (AQ-3)	24-hour Annual	65 $\mu g/m^3$ (federal) 12 $\mu g/m^3$ (CA)	24-hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or less than the standard.
Regional Visibility (AQ-4)	50% of the year 90% of the year	25 Mm-1 (97 miles) 34 Mm-1 (71 miles) Reduce wood smoke concentrations by 15% below 1981 levels.	Range calculated from aerosol data gathered at the D.L Bliss State Park monitoring site shall not violate the TRPA standards, including required reductions.
Subregional Visibility (AQ-4)	50% of the year 90% of the year	48 miles 19 miles Reduce wood smoke concentrations by 15% below 1981 levels. Reduce suspended soil particles by 30% of 1981 base values. Achieve 30 mile visibility when relative humidity is less than 70% (CA/NV).	Range calculated from aerosol data gathered at the Lake Tahoe Boulevard station shall not violate the TRPA standards, including required reductions.
Atmospheric Deposition (AQ-8)	NA	Reduce nitrate transport in the Basin, and reduce NOx emissions produced in the Basin consistent with the water quality thresholds. Reduce VMT in the basin by 10% of the 1981 base values.	Annual average concentrations of particulate NO^3 at the Sandy Way station in South Lake Tahoe are used to determine attainment.

Source: Tahoe Regional Planning Agency

Existing Conditions

The basin shape of the Lake Tahoe Basin influences both its air movement and meteorology. Prevailing winds are from the west and southwest, and temperature inversions caused by atmospheric cooling are common throughout the seasons, occurring approximately 225 to 250 days per year. Mixing depth ranges from 500 feet to as high as 2,000 feet. During summer, nocturnal inversions can trap pollutants and smoke until daybreak when good ventilation commonly occurs. Summer inversions usually dissipate by mid-morning, with the western part of the Tahoe basin being last to experience dispersion due to the shadow effect of the mountains at the western rim of the basin. Winter inversions are typically stronger and persistent, increasing the probability for local emissions to become entrapped for longer periods of time. Air pollutants can also be blown into the Lake Tahoe Basin from areas west (upwind) of the basin.

Wilderness areas are designated Class I airsheds, with strict air quality objectives, to protect and maintain the pristine air resources of wilderness. Desolation Wilderness is located immediately adjacent to the western portion of the South Shore project. The southern part of Mt Rose Wilderness and the southern part of Granite Chief Wilderness are located about 25 to 30 miles north of the South Shore project.

Sensitive urban areas located within the South Shore project area include the City of South Lake Tahoe, Meyers, Christmas Valley, and numerous suburban neighborhoods in the South Lake Tahoe area. Because of Tahoe's basin shape, any urban community with in the Lake Tahoe Basin could be affected by smoke from the South Shore project. However, the communities adjacent to the project or downwind are most likely to experience noticeable effects. Downwind populated areas outside the Basin that may be affected include the Carson and Washoe Valleys to the east, including Carson City, Nevada.

Existing air quality and clarity in the Lake Tahoe Basin meets Federal Air Quality Standards the great majority of the year, and is valued highly by residents and visitors. Traffic during peak recreation periods causes minor air quality impacts from NOx and Ozone buildup when heavy recreation traffic coincides with temporary inversions. Most of the year, prevailing winds carry pollutants eastward out of the basin. Class I air standards for the Desolation Wilderness on the western side of the Lake Tahoe Basin are met, unless air pollution from the Central Valley crosses the Sierra crest into the Lake Tahoe Basin or if wildfire occurs. The greatest impact to air quality in the Lake Tahoe Basin is from wildfire. Smoke from wildfire within the Lake Tahoe Basin itself creates the greatest impact, but impacts are also common from wildfires on adjacent Forests. Less frequently, wildfire from more remote locations can impact air quality in the Lake Tahoe Basin. An example of effects of wildfire within the Basin is the 2007 Angora fire, pictured below.

Smoke at the start of the 2007 Angora wildfire

Smoke darkens the sky during the 2007 Angora wildfire

An example of the effect of more remote wildfire, is the 2008 fire season, when the Lake Tahoe Basin was impacted for over a month by wildfires throughout northern California.

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

The threat of wildfire moving into communities lying within the South Shore project analysis area would remain high. Associated smoke from intense, severe wildfires would create both a nuisance and health concerns in these communities for considerable durations (days or weeks). Air quality standards would not be met for the duration of a wildfire.

Under this alternative, no increase in ozone precursors or PM^{10} emission levels would be produced from burning of activity generated fuels, harvest operations or treatments of existing surface fuels. The potential for substantial degradation of air quality from wildfire in the future as surface fuel deposition occurs would not be reduced. The No Action alternative will not provide any opportunities to reduce existing forest fuels and the hazard they pose in wildland fires. During the flaming phase of a catastrophic wildfire, air quality degradation can exceed Federal and State standards as far as 50 miles down wind. Forest fuels would continue to increase with biomass production out-producing the decomposition rates in this climate. Long-term chronic effects of wildfires include higher PM^{10} emissions, mostly due to large areas of exposed soil and ash in the aftermath of a high intensity wildfire.

Air quality can be severely impacted by particulate matter and other pollutants during large wildfire events. Impacts from the 2007 Angora Fire affected air quality 60 miles away in Reno, Nevada. People with severe respiratory effects from the smoke inundation that were not relieved by staying indoors were advised to leave the area. Sacramento Metro Air Quality Management District published a Public Health Notice on October 14, 2004 in the Sacramento region after ash fallout was reported in Rocklin, Orangevale, and Carmichael from the combined effects of the Power and Freds Fire. Sacramento Metro AQMD warned about for the possibility of smoke impacting visibility down to ground level and also advised against strenuous, sustained outdoor activity due to the possibility of increased levels of particulate matter.

One objective of the South Shore project is to reduce the risk of large uncontrolled wildfires. Wildfires present a risk to the public and result in damage to both the environment (e.g., increased erosion, air quality degradation) and property. Wildfires are known to result in high levels of emissions and associated air quality problems.

Alternative 2 (Proposed Action)

The South Shore project can be divided into two phases in terms of air quality impacts for both action alternatives. The first phase would be the thinning for forest health, removal of small diameter trees for ladder fuel reduction and piling of the activity created fuels. Mechanical operations are estimated to take four to five operating seasons to complete.

The second phase would be piling the fuels followed by prescribed fire (under-story and pile burns). Prescribed burning would begin the second year after mechanical operations begin and would be spread over one to four subsequent years. The pollutants that will be released are the criteria pollutants i.e. PM^{10}, $PM^{2.5}$, Carbon Monoxide (CO), Nitrogen Oxides (NOx), Volatile Organic Carbons (VOCs) and minute quantities of non-criteria air toxics. These pollutants and air toxics are considered unhealthy for the public.

Staging of the prescribed burning and mechanical operations over this period would ensure compliance with federally mandated threshold levels for ozone precursors (VOC and/or NOx). The proposed action is in conformity with the state implementation plan and, therefore, further air quality analysis is not required.

Pile and prescribed burning affects air quality in ways similar to wildfires, however, prescribed burning offers many advantages over wildfire. The effects of prescribed fire can be manipulated to reduce adverse effects to air quality. Guidelines that would reduce the adverse effects of prescribed burns are termed best available control measures (BACM) and are based on "Prescribed Burning Background Document and Technical Information Document for Prescribed Burning Best Available Control Measures" (EPA). BACMs are based on avoidance, dilution, and emission reduction strategies. Smoke mitigation techniques include consideration of atmospheric conditions, season of burn, fuel and duff moisture, diurnal wind shifts, appropriate ignition techniques and rapid mop-up. Following these BACMs and identifying them in burn plans is critical in preventing adverse air quality effects.

Temporary and short-term visibility impacts can be expected in the immediate project area during actual ignition and would be affected by inversions, as well as wind speed and direction. Smoke from burning forest fuels can impact human health, particularly for the ground crews at the site. The localized effects of burning in the project area would be short-term degradation of air quality, primarily during the burnout stage and during nighttime inversions.

The project area lies within the El Dorado Air Quality Management District (EDAQMD). As a matter of regional policy, a smoke management plan would be submitted to and approved by involved agencies prior to any burning activity that would occur within the South Shore project area. Several communities lie within proximity of the areas where both pile and prescribed burning is proposed to occur. Adherence to the smoke management plan for pile and understory burning would reduce negative impacts to communities. By adhering to a smoke management plan approved by the Lake Tahoe Basin Management Unit Forest Supervisor and the EDAQMD, particulate matter emissions from pile or understory burning would not violate California Ambient Air Quality (CAAQ) emission standards. Short duration production of smoke and associated emissions would occur during pile and understory burning. In comparison to a wildfire, prescribed burning produces much less smoke, see the photo below of understory burning for comparison with the Angora fire above.

Example of understory burning

Treatment of fuels under the proposed action would result in decreased smoke production and associated emissions in the event of a wild fire. Because wildfires would become more manageable, associated smoke would be less intense and would produce lower particulate emissions in shorter durations, when compared to the larger and more intense fires that would occur under current conditions. This decrease would result in improved conditions for nuisance and associated health concerns for people in nearby communities. Vegetation management treatments provide the opportunity on a long-term basis to reduce the magnitude of wildfire air quality problems.

Fugitive dust could result from thinning operations, such as skidding and hauling during, dry seasons. Fugitive dust caused by construction and use of unpaved roads can produce PM^{10} in quantities great enough to impair the visual quality of the air. Dust generated by skidding, loading, and site preparation activities also contributes to fugitive dust. These effects are localized and can be mitigated by effective dust abatement methods. Contractual requirements for standard road watering procedure would mitigate much of the problem. Best management practices (BMPs) are specified in Appendix C for mitigating dust produced from operations. As a result of applying these BMPs fugitive dust would be minimized.

Alternative 3

The effects of Alternative 3 are similar to Alternative 2, with the differences being that thinning and controlled burning would occur on fewer total acres. However, the shift from mechanical treatment to hand treatments would leave greater amounts of fuel in hand piles to be burned than would be removed under Alternative 2. The difference in smoke produced under both Alternative 3 and Alternative 2 may not be measurable. Both alternatives would substantially reduce the expected smoke from an uncontrolled wildfire.

Alternative 3 would reduce fugitive dust from thinning operations such as skidding and hauling during dry seasons, because there are fewer mechanically treated acres as well as fewer total acres of treatments. Contractual requirements for standard road watering procedure would reduce fugitive dust, and BMPs specified in Appendix C for mitigating dust would also reduce dust produced from operations. As a result, fugitive dust would be minimal.

Cumulative Impacts

Alternative 1 (No Action)

Because there would be no prescribed burning under Alternative 1, there would be no direct effects from smoke in the project area under this alternative. While the risk for wildfire effects would increase, an actual wildfire occurrence is not a reasonably foreseeable or predictable event, therefore there are no cumulative effects under Alternative 1.

Alternative 2 (Proposed Action)

All prescribed burning is coordinated with the state and local air quality agencies to ensure that atmospheric stability and mixing heights are advantageous for dispersion of emissions. El Dorado County Air District is the permitting agency for a required smoke management plan. The smoke management plan would prescribe weather conditions (mixing heights and transport winds) that would avoid smoke effects as much as possible, in the City of South Lake Tahoe and other communities in the South Shore projects area, and Desolation Wilderness, a Class 1 airshed.

In addition to prescribed burning for the South Shore project, other vegetation burning on public and private land is expected to contribute short duration smoke and associated particulate matter to existing emissions from residential heating and vehicle traffic into the atmosphere. However, although prescribed fire would contribute to cumulative effects, the effects would not exceed state and local air quality standards.

If a wildfire event does occur after project implementation of the Proposed Action, concentrations of all smoke related emissions would be expected to be less than in the No Action alternative due to the reduced levels of fuel available.

In addition to fugitive dust from implementation of the South Shore project, there is likely to also be fugitive dust from recreational activities and firewood cutting of local residents. The cumulative effect from the South Shore project for fugitive dust would be minimal, due to implementation of BMPs and required road watering to prevent dust.

Alternative 3

Cumulative effects for smoke would not be measurably different from Alternative 2. There would be a minor reduction in the cumulative addition of fugitive dust, due to fewer mechanically treated acres and fewer acres treated overall.

L. Heritage and Cultural Resources

Scope of the Analysis, Indicators, and Issues

The area of potential effects (APE) for heritage and cultural resources analysis extends to proposed areas of disturbance across NFS lands within the South Shore project area. The survey of the proposed treatment areas was conducted at the intensity appropriate to identify all heritage resources that might be affected by project activities. Copies of all archaeological surveys are on file at the LTBMU supervisor's office.

Current environmental review policies must be in compliance with antiquities mandates and guidelines established by NEPA, Section 106 and 110 of the National Historic Preservation Act (NHPA), and regulations of the Advisory Council on Historic Preservation (e.g., ACHP, 36 CFR 800). These mandates require public agencies to identify, evaluate, and protect heritage resources on lands under their jurisdiction, and to ensure that their actions do not inadvertently impact heritage remains. Tasks that were conducted for this analysis included the following:

- Pre-field research to determine the presence of known cultural properties, adequate previous surveys, and expected level of archaeological sensitivity of the project area;
- An archaeological field surface survey of previously unsurveyed portions of the project area; and
- Reporting field findings to include a general assessment of project-related impacts to inventoried heritage properties and recommendations for mitigating measures to minimize the adverse impacts (where appropriate).

The inventory of heritage resources within the South Shore project was guided by the following two documents: the *First Amended Regional Programmatic Agreement* among the U.S.D.A. Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region (USDA Forest Service, et al. 2001) and the *Interim Protocol* for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects Annex to Stipulation IX in the First Amended Regional Programmatic Agreement among the U.S.D.A. Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region [Regional PA] and Stipulation XIV in 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 [Sierra PA] (USDA Forest Service, et al. 2004). The above PA's provides direction regarding the treatment of heritage resources; including survey strategy, mitigation measures, and procedural details of section 106 compliance.

Existing Conditions

The South Shore project has had numerous previous heritage surveys conducted across the area. At the inception of the project it was determined that 3894 acres (about 45%) of the projects slightly less than 11,000 acres had been inventoried adequately to the standards outlined in the *First Amended Regional Programmatic Agreement* and the *Interim Protocol*. There were 70 previous inventories that intersected the current project area. Of those 15 were determined to not be adequate to present standards and 55 previous projects were considered adequate to the PA standards.

The South Shore project is large and topographically diverse. The *First Amended Regional Programmatic Agreement* and the *Interim Protocol* were used to develop an appropriate inventory plan (USDA Forest Service, et al. 2001; USDA Forest Service, et al. 2004). A detailed pre-field inventory of all known sites and possible historic activity areas was conducted. These data were compared to the proposed project and a survey strategy was developed. Generally all areas of proposed project impacts were surveyed unless the area was too steep or thick with vegetation for safe field survey (USDA Forest Service, et al. 2001; USDA Forest Service, et al. 2004). Additionally, areas of previous adequate survey were not resurveyed, but all known site locations were revisited and sites were brought up to current recording standards. Any known or suspected site locations were visited, regardless of the slope or vegetation on which they were located.

A total of 188 heritage resources were investigated. Seventeen of these sites were recorded in prior surveys, but could not be relocated during site re-visitation, for a variety of reasons. Sixteen previously recorded sites were determined to be outside the project area of potential effect, and would not be affected by project activities. Seven sites, of which four are not eligible to the NRHP and three are eligible to the NRHP, are recreation residence tracts and lie outside the scope of the current heritage inventory. Ten sites were determined through a records search to have been previously determined not to be eligible to the NRHP and thus require no further work.

The remaining 138 heritage resources were identified during previous (121) and new survey (17). These include 89 historic sites, 40 prehistoric sites, and 9 with both prehistoric and historic components.

Direct and Indirect Environmental Consequences

Direct physical impacts to heritage resources can occur if alterations are made to the integrity of the resource itself or to its surroundings. A project is regarded as having an effect on a heritage property if it alters any of the characteristics that qualify the property for inclusion in the National Register of Historic Places (NRHP). An adverse effect is one that diminishes the integrity of any of those characteristics that qualify the resource for inclusion in the NRHP. Projects are considered to have no adverse effect or no effect if sites in the area have been shown to be ineligible or the impacts to the qualities that make the heritage resource important are mitigated as defined in 36 CFR 800.9(c)1.

Although the APE received systematic surface archaeological investigations, it is possible that buried or concealed heritage resources could be present and detected during project ground disturbance activities. In the event of fortuitous discoveries of additional heritage resources, which have not previously been inventoried, project activities would cease in the area of the find and the project operator would consult the LTBMU archaeologist for recommended procedures.

In the event that human remains are discovered during project activity, law requires that project managers contact the county coroner. If the remains are determined to be of Native American origin, both the Native American Heritage Commission and any identified descendants should be notified (Health and Safety Code Section 7050.5, Public Resources Code Section 5097.94 and 5097.98).

Alternative 1 (No Action)

Under the No Action alternative, existing fuel conditions and conifer encroachment into aspen stands would continue to present a hazard to cultural and heritage resources. If a wildfire occurred under these conditions, it would be expected to be a high intensity crown fire over much of the project area. A high intensity wildfire would have the potential to consume or kill aspen arborglyphs, and damage cultural sites and heritage remains.

Action Alternatives: Alternative 2 (Proposed Action) and Alternative 3

Alternative 2 and Alternative 3 contain the same design criteria for heritage and cultural resources, and the effects would be the same for both action alternatives. Therefore, both action alternatives will be discussed together. The action alternatives would increase the protection of heritage and cultural resources by reducing the likelihood for high intensity wildfire in the project area. No direct or indirect negative impacts are anticipated because project activities would be controlled through identification and protection of sites, either through avoidance, or implementation o hand treatments to reduce fuels in sites recommended by the Forest Service archeologist, and consultation with the Washoe Tribe of Nevada and California. In some instances the Washoe Tribe may implement project activities to reduce fuels while protecting cultural sites. Removal of conifer encroachment from aspen stands would enhance the health and integrity of aspen stands where arborglyphs are present.

Cumulative Impacts

Alternative 1 (No Action)

Because no fuel reduction or aspen stand enhancement would occur under the No Action alternative, the No Action alternative would not generate cumulative effects per se.

Alternative 2 (Proposed Action) and Alternative 3

Cumulative effects are similar for both action alternatives. None of the proposed activities in either of the action alternatives would negatively affect the physical attributes of the cultural and heritage resources in the South Shore project area, therefore there would also be no cumulative effects from implementation of either of the action alternatives..

Irreversible and Irretrievable Commitments of Resources

Impacts to cultural or heritage resources are generally regarded as irreversible in nature if they directly and physically affect the condition of the site. The associated loss of any historic properties or characteristics may be regarded as irretrievable as well, because historic values and qualities cannot generally be salvaged or regained.

Due to the unpredictable nature of high intensity wildfire effects, Alternative 1 has potential for irretrievable and irreversible loss of heritage and cultural resources. None of the proposed activities in either of the action alternatives would negatively affect the physical attributes of the cultural and heritage resources in the South Shore project area.

M. Scenic Resources

Scope of the Analysis, Indicators, and Issues

The South Shore project analysis area is substantially larger than the area proposed for treatment under all action alternatives; the project analysis area is over 86,000 acres while the area proposed for treatment is approximately 10,670 acres for the proposed action. This larger project analysis area includes the hillsides that extend beyond the WUI. Management of scenic resources considers background views of the landscape as well as closer foreground and middleground views. For this reason, the analysis of effects to scenic resources addresses the entire, larger project analysis area including direct, indirect, and cumulative effects associated with proposed management activities. Indicators of effects to the scenic resource include meeting visual quality objectives (VQOs) of retention and partial retention identified in the Forest Plan; changes in foreground, middleground, and background views, and scenic stability. Concerns for scenic resources include potential loss or reduction in value of scenic views of healthy forest landscapes, impacts to water clarity, and loss or reduction in scenic views of meadows and aspen. See Appendix E for the VQOs and design criteria that apply to this project.

Existing Conditions

The scenic resources of the LTBMU are highly valued by the Forest's visitors and residents. National visitor use monitoring (NVUM) surveys in 2002 identified that "viewing of National Forest lands" is the fourth most frequently recorded primary visitor activity on the LTBMU following hiking, skiing, and relaxing. For these three primary visitor activities, scenic quality plays a substantial role in the visitor experiences and helps define what "Lake Tahoe" means to people (USDA FS LTBMU 2002).

The landscape character of the project area includes the granitic mountains of the Sierra crest as well as Carson mountain ranges. This alpine environment is characterized by dense coniferous forests with occasional stands of large diameter trees, glacially-formed lakes, rock outcrops, meadows and other riparian environments including stands of aspen trees. Other valued scenic attributes of the project area include clear skies, and the clear, blue waters of Lake Tahoe and the area's other lakes. These scenic attributes are elements of the visual landscape which are important to visitors and locals - the elements that help to define the visual "identity" of a place.

Views of the project area from several travel routes and communities within the project area are valued by the public. Community development within the project area includes the City of South Lake Tahoe and the town of Meyers. US Highway 50, one of the major east-west travel routes in the region passes through the project area from Echo Summit in the west to Stateline, Nevada in the east. State Highway 89 carries travelers through the project area from Luther Pass in the south to the project's northern boundary near Cascade Lake and is a designated California Scenic Highway. Pioneer Trail connects the communities of Meyers and Stateline and is an important travel route. Other important non-motorized travel routes include the area's trail systems. The Pacific Crest Trail, Tahoe Rim Trail, and Hawley Grade Historic Trail each pass through the project area. Views of the project area are managed by both the USFS and Tahoe Regional Planning Agency.

Views of the current forest density levels are a result of Comstock era clear-cutting followed by a management policy of fire prevention. While regular low-intensity fires prior to the 1880's maintained a relatively open, low density, forest with a mosaic of tree size classes and openings, the suppression of this natural cycle added to the Comstock logging has resulted in the current forest vegetation structure, which has never been seen before in this landscape. The current densely forested hillsides of the project area provide visual screening for much of the community development including houses, businesses and infrastructure. However, the current landscape has low scenic stability.

Scenic stability is a measure of a landscape's ability to perpetuate its valued scenic attributes over time**.** The forested landscape of the project area is at variable risk of high intensity wildfire – fire which could kill all trees within the burn area and temporarily darken the clear skies with smoke. The overly dense forest stands have resulted in excessive competition between individual trees, leaving them weakened and susceptible to fatal insect infestations, as evidenced by the dead and dying trees seen in some areas of the landscape. Additionally, scenic meadows, riparian corridors and aspen stands are being encroached upon by lodgepole pine and white fir which are slowly converting these areas to coniferous forest in the absence of natural fire regimes. While threats to Lake Tahoe's clarity primarily come from sediment and airborne dust associated with ground disturbing development projects, catastrophic wildfire also poses a substantial risk to this scenic resource. Watershed erosion prediction models show the potential for erosion and sediment flow to the lake following a substantial, high-intensity wildfire to far exceed background sediment loads in a non-fire or low-intensity fire condition (refer to the Water and Soils sections for a more detailed discussion of sedimentation and erosion).

Current landscape effects from fuels management activities within the project area designed to reduce the threat of wildfire include the use of hand crews to cut and pile smaller diameter vegetation for subsequent burning. These burn piles are required to cure or dry for one to two years prior to burning and can only be burned when regulated "burn days" occur. This has resulted in existing short-term visual impacts within some foreground views of the landscape.

Distance zones are divisions of the landscape being viewed. They are used to describe the part of a characteristic landscape that is being inventoried or evaluated. The three distance zones are foreground, middleground, and background. The foreground zone is based upon distances at which details can be perceived. In normal foreground views, the individual boughs of trees form texture. The foreground is usually limited to areas within one-quarter to one-half mile of the observer, but must be determined on a case-by-case basis, as is true of all distance zones. The middleground distance zone extends from the foreground to three to five miles from the observer. Texture is normally characterized by the masses of trees in stands of uniform tree cover. Individual tree forms are usually only discernable in very open or sparse stands. The background zone extends from the middleground to as far as the eye can see. Texture in stands of uniform tree cover is generally weak or non-existent. In very open or sparse vegetation stands, texture is often seen as groups or patterns of trees in the background zone. (1974, US Forest Service, Agriculture Handbook Number 462)

The project analysis area occurs within areas of the forest that have visual quality objectives (VQOs) of retention and partial retention as identified in the Forest Plan. The retention VQO provides for management activities on National Forest lands which are not visually evident. Under the retention VQO, activities may only repeat form, line, color, and textures that are frequently found in the characteristic landscape. The partial retention VQO provides for management activities that remain visually subordinate to the characteristic landscape. Activities under partial retention may repeat form, line, color, or texture common within the landscape, but changes in their qualities of size, amount, intensity, direction, pattern, and duration must remain visually subordinate when compared to the surrounding landscape character. Supporting scenic resource mapping of the project area also identifies scenic classes. Class One landscapes have the greatest valued scenic attributes (attractiveness and visibility) within a range of one to seven. The project area contains scenic Class One and Class Two landscapes, both of which are considered to have "high" scenic value (Map 19).

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Alternative 1, the No Action alternative, would result in no short term or direct changes to existing scenic resource conditions. The visual quality objectives (VQOs) of retention and partial retention identified in the Forest Plan are currently being met within the landscape of the project area and would continue to be in compliance barring any landscape-scale events such as forest stand die-off, blow-down, or severe wildfire which would significantly alter the visual character of the area. The scenic attributes of the area would remain in their current condition.

Long term and indirect effects of the No Action alternative could result in a decrease in the presence of valued scenic attributes, and may result in a situation in which the VQOs are not met. The No Action alternative would not change the current density and composition of the forest vegetation. By taking no action, the existing forest vegetation would continue to compete for scarce water, nutrients, and sunlight resulting in increasingly weak individual trees that are increasingly susceptible to insect mortality and wildfire. If no action is taken within the project area the probability of stands of live trees dying and/or being killed during wildfire events would increase. These possible events would result in the loss of the scenic attribute of forested views at the foreground, middleground, and background level. Indirect effects of potential severe wildfire would include the temporary loss of clear skies resulting from smoke. Another indirect effect of a wildfire event linked to the no action Alternative would be an increase in the potential for sedimentation and erosion which would negatively affect the scenic attribute of clear waters within the project area and Lake Tahoe. Under the No Action alternative, conifer encroachment into aspen stands, meadows and riparian corridors would not be treated and would continue to increase. The indirect effect of taking no action to address this would be a decreasing presence of these scenic attributes and landscape features.

Alternative 2 (Proposed Action)

Alternative 2 would implement three types of thinning treatments within approximately 10,670 acres of the project area over a 7-15 year period; cut-to-length and whole-tree mechanical treatments, and hand-thinning treatments.

Direct effects to scenic resources within the project area include a change to the current density and composition of forest vegetation, evidence of cut tree stumps, creation of cleared landing areas to facilitate mechanical treatment, and creation of burn piles associated with hand treatment. Proposed vegetation treatments that alter the forest vegetation would result in stands that are visually more open than existing conditions. Historically the landscape within the project area experienced more frequent surface fires which resulted in a more open forest character compared to current conditions. The effects of implementing the proposed vegetation treatments would mimic these historic conditions and would be consistent with the Forest Plan VQOs of retention and partial retention.

During vegetation treatment implementation, management activity in the form of mechanical equipment or hand crew activities will cause a visual impact that exceeds VQO standards, but these activities will occur within short time durations of usually less than one month. Proposed landings required to facilitate mechanical treatments would average less than one acre in size and the maximum size would be two acres. These clearings would be treated following their use to reduce their visual contrast with the surrounding landscape. Implementation of these landing areas is considered a short-term impact that would temporarily exceed compliance with the VQOs. These areas would comply with the VQO following implementation of proposed restoration efforts and one to three years of vegetative growth. Similarly, the creation of burn piles associated with hand treatments would remain in the landscape for one to three years following their creation until they were adequately cured and burned during available burn days. Smoke from prescribed fire would likely be visually evident, however, it would be short-lived and minimized as part of any approved burn plan. Evidence of prescribed burning would be visually evident in foreground views of the landscape until understory vegetation covered any partially burned material. When these burn piles are visible in foreground views from neighborhoods and travel routes (approximately 200 feet from viewing location) they would not comply with the VQO of retention or partial retention until they were burned. Following the burning of these piles, the area would comply with Forest Plan VQOs. The evidence of cut stumps will be visually apparent when viewed in close foreground range. The action alternatives includes a measure to limit stump heights to a six-inch maximum (measured from the uphill side of stump) to minimize this visual impact.

Foreground views are the most sensitive to the effects of proposed management activities. Changes to middleground and background views may occur as a result of implementing the vegetation treatments proposed in Alternative 2, however these changes will not affect the area’s compliance with Forest Plan VQOs nor the perpetuation of identified valued scenic attributes. An indirect effect of implementing the proposed action would be the increased viewing distances through foreground forest stands. Views that were previously blocked by dense vegetation may be revealed following treatment activities. This is likely to result in both positive visual effects, such as reclaimed views of Lake Tahoe or surrounding landforms, and in negative visual effects, such as exposed views of neighborhoods or community infrastructure.

Implementation of the proposed action would have an indirect benefit to the scenic stability of the project analysis area. Reduction of forest vegetation and biomass would stimulate the growth of larger, more disease-resistant trees, and reduce the probability of the area suffering high levels of mortality from disease, drought, or severe wildfire. This reduced probability of landscape-scale tree mortality would increase the likelihood that the area would retain its compliance with Forest Plan VQOs. Additionally, the removal of conifers from aspen stands, meadows and riparian corridors would help perpetuate these scenic valued landscapes into the future. While smoke associated with prescribed burning of hand treated piles would have an effect on air clarity, this effect is less than the effect of smoke associated with a wildfire in the project area if vegetation were untreated. Any visual impacts to water clarity resulting from any sedimentation and erosion associated with treatment activities are anticipated to be short lived or non-evident. If a wildfire were to burn through the area following implementation of the proposed treatments, the amount of sedimentation and erosion and the resulting decrease in the valued scenic attribute of water clarity is anticipated to be noticeably less than if the same fire were to burn through the same area if proposed treatments were not implemented (USDA FS LTBMU 2007 unpbl.).

Alternative 3

The effects of implementing Alternative 3 on scenic resources within the project analysis area are nearly the same as those of implementing Alternative 2, with a few exceptions.

Alternative 3 would implement vegetation treatments within fewer acres compared to Alternative 2, especially within wildlife protected activity centers. The effects of this change from Alternative 2 would not affect the area’s compliance with its adopted VQO. By treating fewer acres under Alternative 3 there would be an incremental reduction in the benefit of improving landscape scenic stability compared with the effects of implementing Alternative 2.

The total number of acres of hand treatment proposed under Alternative 3 is greater than under Alternative 2. By implementing approximately 1,000 more acres of hand treatment, a greater number of burn piles will be created within the project area. An increased number of burn piles visible within foreground views from neighborhoods and travel routes would represent a greater effect to scenic resources compared to the effects of implementing Alternative 2. However, as noted in the analysis of Alternative 2 effects, the scenic impact of burn piles is a short term effect lasting one to three years following their creation until they are adequately cured and burned during available burn days, and until understory vegetation obscures evidence of partially burned material.

Alternative 3 proposes a greater number of acres for mechanical treatment by cut-to-length techniques compared to whole-tree techniques in Alternative 2. Implementing Alternative 3 would result in some cleared landing locations that were smaller in size than those needed under Alterative 2. This would reduce the total number of landing acres under Alternative 3 that experience short-term negative scenic resource effects compared to Alternative 2.

Cumulative Impacts

Alternative 1 (No Action)

Cumulative effects of taking no action to treat forest health conditions within the project area take into account the past, present, and reasonably foreseeable future management activities of other ownerships and non-WUI lands within the project area. Previous forest fuel reduction activities on Forest Service lands and other ownerships have improved the landscape's resilience to wildfire and increased scenic stability. During the 2007 Angora Fire analysis shows that areas that were previously treated to reduce fuel levels affected fire behavior and intensity and resulted in lower tree mortality levels. Previous treatments are limited in their scope and effectiveness due to limited acreage and the age of these treatments. The effect of previously treated areas on overall forest health and WUI protection is not enough to maintain scenic stability at the landscape level into the future. If the Forest Service takes no action within the project area and other ownerships are also unable to take actions to improve forest health and reduce the density of vegetation and biomass, the chances of natural or human started wildfire rapidly spreading across the landscape could increase and the scenic stability of the area would decrease. A rapid and severe wildfire could pose a serious threat to community infrastructure, homes and forest resources, including valued scenic attributes. If other ownerships are able to implement treatments while the Forest Service takes no action within the project area, the effects are likely to improve scenic stability and visual conditions within foreground views, but are unlikely to improve scenic stability and visual conditions within middleground and background views. This is due to the ownership patterns within the project area and the fact the vast majority of lands within the middleground and background views as seen from travel routes, communities, and neighborhoods are Federal lands managed by the Forest Service.

Alternative 2 (Proposed Action)

Previous forest fuel reduction and forest health activities on Forest Service lands and other ownerships have improved the treated area's resilience to wildfire and increased scenic stability, however the scale of these previous activities have not resulted in a landscape-scale change that stabilizes or improves scenic stability. Cumulative effects of implementing the proposed action would build on these previous treatments and result in change to the landscape of the WUI that would improve scenic stability over the next 10 to 25 years.

Alternative 3

Cumulative effects would be the same as the proposed action. Implementing Alternative 3 would also build on previous fuel reduction and treatments to improve forest health and result in change to the landscape of the WUI that would improve scenic stability over the next 10 to 25 years.

N. Recreation

Scope of the Analysis, Indicators, and Issues

The South Shore project analysis area provides the appropriate scope for analysis of existing recreation conditions and the effects of the action alternatives. Indicators of effects are linked to the types of activities that would occur with implementation of the alternatives, including the risk for recreation opportunities to be lost due to wildfire; effects from user-created, unauthorized travel routes; restrictions or closures on areas, trails, and roads; changes in locations for obtaining Christmas trees; and traffic congestion. Some existing recreation use generates resource management and environmental concerns within the project area, as detailed in the following paragraphs.

Fire

Many visitors enjoy camp fires as a part of their recreation experience. In some instances this type of fire is legal, occurring within a fire ring at a developed facility or in accordance with a fire permit. In other instances users may start an illegal campfire by violating established fire restrictions. The effects of illegal fire use can be serious. The 2007 Angora Fire (within the project area) is credited as being started by an illegal campfire.

Effects of illegal campfires include visual scarring of the landscape with evidence of soot, stone fire rings, and partially burnt wood. Gathering of wood for such fires may also have an impact on the environment. When a recreational fire escapes control and causes wildfire the impacts are much greater. As seen in the Angora Fire, loss of homes and infrastructure within the Wildland Urban Interface, damage to wildlife habitat, impacts to water and air quality are all direct impacts. While no lives were lost as a result of the Angora Fire, this is a possible serious consequence of wildfire. Indirect impacts of wildfires include a potential decrease in recreation visitors which in turn impact the economic vitality of the area. Forest closures following a fire for resource projection also limit recreation access and opportunity.

User Created Trails

A well designed trail system provides for a range of recreation experiences and challenges, provides a means for users to get from one place to another, and minimizes resource impacts and maintenance requirements. Occasionally, trail users take “short cuts” from one trail to another, or try to create their own, new trail. Such user created trails often have negative impacts to wildlife habitat, sensitive plant population, water quality, other recreation resources, and public safety. In many locations within the project area, the density of existing vegetation or surface material physically discourages users from leaving a designated trail.

In some instances, off-highway vehicle users access areas of the forest which have been administratively closed to such use in order to protect resources or non-motorized recreation experiences. Such illegal use also creates impacts associated with user created trails.

Traffic Congestion

During peak summer and winter recreation periods traffic associated with forest users can cause congestion on arterial travel routes such as Highways 50, 89, and Pioneer Trail. Popular developed recreation facilities such as those found along Hwy 89 near Camp Richardson generate and attract visitors with private vehicles. Parking demand and pedestrian/bicycle/vehicle conflicts at these sites can cause delays in travel times and generate concerns for public safety.

Existing Conditions

The Lake Tahoe Basin is an internationally recognized recreation destination attracting visitors year-round. Winter and summer seasons represent the times of greatest visitor concentration. National Forest System lands within the project area contain the most concentrated recreation use within the Lake Tahoe Basin. Annual recreation use within the project area is estimated to be 2,261,800 visitor days (one person engaged in an activity for 12 hours, or 12 visitors engaged for one hour each) (USDA FS LTBMU 2004).

Recreation visitors within the project area come from around the world and nation, however the greatest concentration of users come from nearby population concentration centers such as San Francisco, Sacramento, and Reno that are within driving distance. Additionally, many local residents enjoy recreation activities on National Forest lands and consider this public land part of their "backyard". Public interest in recreation resources and access within the project area is high. Many visitors have generational connections to Lake Tahoe, with families regularly sharing their favorite Tahoe locations with younger generations.

Over the last several years the LTBMU has sold inexpensive permits to the public authorizing the cutting of small diameter trees during the winter holiday season. This has been a very popular program with the public and all available permits have been sold before demand for them waned. This program has encouraged the public to experience dispersed National Forest System lands during the winter when they may not ordinarily do so.

Developed recreation facilities (Map 20) within or adjacent to the project area include day use beach and picnic areas, family campgrounds, resorts, interpretive and visitor information sites, recreation residences, and organizational camps. Existing developed recreation sites within the project area are listed below. Sites listed in **bold** are located adjacent to or within treatment areas under the action alternatives.

-Angora Lakes Resort
-Baldwin Beach
-Berkeley Camp
-Big Meadow Trailhead
-Camp Concord
-Camp Richardson Corral
-Camp Richardson Resort
-Camp Shelly
-Echo Lakes Chalet
-Fallen Leaf Campground
-Glen Alpine Springs Resort
-Glen Alpine Trailhead
-Heavenly Mountain Ski Resort
-Kiva Picnic Area
-Meyers Interagency Visitor Center
-Pope Beach
-Tallac Historic Site
-Taylor Creek Visitor Center
-Valhalla Estate.

Dispersed recreation facilities include trailheads and a network of trail and road systems.

Forest Service system road and trail networks provide valued public recreation opportunities. Among the important trails within the project area are portions of the Pacific Crest Trail, the Tahoe Rim Trail, the Hawley Grade trail (a portion of the Pony Express trail), and the Class One

Pope-Baldwin bike trail. Existing dispersed recreation sites within the project area are listed below. Sites listed in **bold** are located within or adjacent to treatment areas under the action alternatives.

-Angora Lake Trailhead
-Fountain Place Trailhead
-Freel Roadless Area
-High Meadows Trailhead
-Luther Pass Overflow Campground
-Meiss Meadow Cabin
-Meiss Roadless Area
-Mt. Tallac Trailhead
-Sand Pit OHV Area
-Sawmill Pond,
-Taylor Creek Snopark.

The 2006 National Visitor Use Monitoring project (USDA FS LTBMU 2006), a Forest Service-wide program aimed at understanding visitor use patterns, demographics, and satisfaction levels, indicated that LTBMU users participated in the following primary activities at the following rates:

54% - Viewing natural features and scenery
45% - Relaxing, or “hanging out”
45% - Hiking or walking
45% - Viewing wildlife
31% - Downhill skiing
29% - Driving for pleasure

While these statistics are for total LTBMU recreation use, the range of activities can be inferred to apply within the project area. It is also important to note that one activity is not exclusive of others. For example, virtually all recreation experiences include viewing of natural scenery.

In addition to National Forest recreation opportunities, California State Parks, City of South Lake Tahoe, and private recreation providers offer valued opportunities for recreation within the project area.

The Forest Plan identifies areas of different recreation opportunity spectrum (ROS) classifications based on a range of settings and probable activities that contribute toward the goal of providing a variety of outdoor recreation opportunities. A recreation opportunity setting is defined as the combination of physical, biological, social, and managerial conditions that give value to a place. By combining variations in these conditions it is possible to provide a diversity of recreational settings for visitors to enjoy. The ROS classifications within the South Shore area are as follows (USDA FS LTBMU 2004):

Primitive / Non-motorized	43, 067 acres
Semi-Primitive / Non-motorized	5,430 acres
Natural / Roaded	28,166 acres
Rural	7,901 acres
Urban	201 acres

Direct and Indirect Environmental Consequences

Alternative 1 (No Action)

Alternative 1, the No Action alternative, would result in no short term or direct effects to the recreation resources, access or quality of recreation experience within the project area. Existing patterns of recreation use are expected to remain, and to increase in volume over time. The potential for establishment of user-created trails remains, as does the potential for wildfires being started by legal or illegal recreation campfires. Both the establishment of user-created trails and ignition of human triggered wildfire are difficult measures to quantify or assign predictive probabilities.

The density of dead and downed vegetation that would remain under Alternative 1 provides an abundance of available fuel wood which makes the establishment of a campfire relatively easy. The convenience of available fuel wood has the potential to increase the chance that a recreation user would create a campfire. Campfires have the potential to escape control and ignite wildfires. If a wildfire from any cause were to ignite within the project area, high levels of standing and downed vegetation combined with dry, windy weather, could lead to a wildfire of high intensity, which would be likely to threaten ecological resources as well as recreation opportunities and facilities along with community infrastructure.

If a high intensity wildfire were to burn within the project area the resulting landscape's recreation opportunities would be altered. Following a wildfire event, recreation access may be limited through a forest closure for forest resource protection, as was seen following the 2007 Angora Fire. When public recreation access is allowed within a recently burnt landscape, the quality of the recreation experience is altered. Greater numbers of hazard trees would be anticipated, and the visual character of the landscape would be changed from the scenic attribute of forested upland to a more barren landscape. Observation of forest regeneration would be an additional potential activity, however, when compared with recreation in the same landscape prior to severe wildfire, recreation users may find it less attractive, with fewer opportunities.

Under Alternative 1 the potential for establishment of user-created trails would remain somewhat restricted by the current density of standing and downed vegetation within dispersed recreation areas. On-going trail access and travel management planning and implementation within the project area include efforts to eliminate user-created trails that pose a threat to ecological resources or public safety. Maintenance of a high quality Forest Service system trail network also serves to discourage the establishment of user-created trails.

The No Action alternative would not affect the current Christmas tree cutting program administered by the LTBMU; there would be no project-related restrictions or closures on areas, trails, and roads; and there would be no project-related increase in traffic congestion.

Alternative 2 (Proposed Action)

Implementation of Alternative 2, the proposed action, would have direct effects to the recreation resources within the project area. The risk of potential wildfire ignited by recreation campfires is anticipated to decrease as a result of implementing Alternative 2. The volume of standing and downed vegetation would be reduced which could decrease the likelihood that such fires would be established in the first place. If a campfire escaped containment, the forest vegetation following treatment would be less likely to burn at a high intensity level and would be less likely to threaten ecological resources or community infrastructure. The treatment of vegetation under Alternative 2 would increase the landscape's resilience to provide quality recreation opportunities following wildfire.

The forested landscape that would result from implementing Alternative 2 would be more open in character than the current landscape. Much of the standing and downed vegetation that currently helps to keep recreation users on designated trails would be removed. Removal of this material could tempt users to create trail short-cuts or new trails within the project area. The proposed action includes measures, such as placement of physical barriers, increased signage and where feasible, increased enforcement, to discourage establishment of user-created trails.

A short-term direct effect during project management activities would be temporary Forest Closures implemented to protect the public from safety hazards associated with tree removal and operation of mechanical equipment. These closures would reduce the public’s opportunity to access limited areas of public land for dispersed recreation for periods ranging from one to six weeks. Advanced signage and public outreach would notify as many people as practical of proposed closure periods ahead of time, allowing them to make alternate recreation access plans. Similarly, management activities within or adjacent to developed recreation facilities have the potential to negatively affect visitor’s recreation experience. The action alternatives include measures to manage the timing of fuels management activities when practical within these areas to non-peak season periods when visitation rates are anticipated to be lower.

During fuels management activities trucks and other equipment will be utilizing public travel routes. These additional vehicles have the potential to increase traffic congestion and negatively affect the driving experience of highway users. Since “driving for pleasure” is an identified recreation use within the project area, this user group, as well as those traveling to recreation destinations could be affected. Landing or staging areas associated with mechanical treatment units that are located near residential roads, especially those roads that provide public access to general forest areas, will alter the visual landscape and the experience of those recreating in these areas during and following treatment. Measures are incorporated within the action alternatives to return these areas to as “naturally appearing” a condition as practical following use.

Implementation of Alternative 2 would have short term effects on the current Christmas tree cutting program administered by the LTBMU. Opportunities for individuals and families to cut these small diameter trees within the project area would be reduced during the short term in areas that were recently treated for fuels reduction. This opportunity is unlikely to be eliminated, however, as forest stand areas are proposed for treatment during different years. This schedule will allow for treated portions of the project area to re-grow small, desirable “Christmas trees” while other untreated portions of the project area continue to offer suitable trees and this valued recreation opportunity. Additionally, the tree cutting program is Basin-wide and the opportunity to select and cut Christmas trees will not be affected in areas outside of the project area.

No changes to the recreation opportunity spectrum classification are anticipated as a result of implementing Alternative 2.

Alternative 3

Implementation of Alternative 3 would treat fewer overall acres of the landscape and would include more hand treatments compared to Alternative 2. The effects of implementing Alternative 3 would be the same as implementing the proposed action with the following exceptions:

With fewer acres treated compared to Alternative 2, the potential for establishment of recreation campfires across the landscape is somewhat greater under Alternative 3, but less than Alternative 1. This measure is difficult to predict or quantify. If such a fire were to escape containment and spread to surrounding vegetation, the potential for a wildfire of an intensity that could threaten ecological resources and community infrastructure would be slightly greater under Alternative 3 compared to Alternative 2. This comparative probability is also dependent on other conditions, including atmospheric conditions, and is not solely a function of acres of forest treated for fuel reduction.

The potential of user-created trail establishment is not anticipated to be different between Alternatives 2 and 3. Alternative 3 would treat fewer acres, however, therefore the current vegetation density remaining across the landscape in this alternative could serve as a greater deterrent to these trails compared to the proposed action.

Fewer temporary public access Forest closures would be required. This would reduce the temporary negative effects on recreation access associated with Alternative 2 management activities.

Fewer vehicle trips will be required to implement Alternative 3 compared to Alternative 2. This is due to the reduction in mechanical treatment acres. Additionally, the increase in cut-to-length operations compared to whole tree operations would reduce the acreage of required landing or staging areas. Within neighborhood areas the reduced acreage of landings will have less effect on recreation experience than the larger landings associated with the whole tree operations proposed in Alternative 2.

Cumulative Impacts

Alternative 1 (No Action)

Because there would be no direct or indirect effects to recreation resources as a result of the No Action alternative, there would be no cumulative effects.

Alternative 2 (Proposed Action)

Cumulative effects of the proposed action would be additive to the effects of recreation activities and other management activities affecting recreation use within the analysis area. These cumulative effects would be both positive and negative in nature when combined with other fuel reduction, forest health, the Angora fire and follow-up area restoration, and recreation facility improvement projects in the South Shore project analysis area.

Past, present, and reasonably foreseeable future management activities, particularly those implementing access and travel management projects (ATM project proposal is anticipated to be analyzed during NEPA process in 2009), may add to the cumulative effects of the proposed action. Temporary recreation closures to improve the sustainability of Forest Service system trails within the project area would be short in duration and limited in scale. These temporary closures, coupled with temporary closures associated with the proposed action have the potential to reduce public access to dispersed recreation opportunities. Establishment of user created trails within the analysis area is unlikely to increase as a result of cumulative effects. Access and travel management activities are anticipated to reduce the overall number of user created trails, and develop a sustainable trail system that both meets user needs and protects resources.

The proposed action measures to discourage establishment of user-created trails, such as placement of physical barriers, increased signage, and increased enforcement where feasible, would coordinate with on-going trail access and travel management planning and implementation within the project area. On-going trail access and travel management planning and implementation within the project area include efforts to inventory and eliminate user-created trails that pose a threat to ecological resources or public safety. These efforts also serve to discourage the establishment of user-created trails through the maintenance of a high quality Forest Service system trail network. However, the cumulative effect of the increased openness caused by implementation of Alternative 2 is likely to increase the need for efforts to inventory and eliminate user-created trails that pose a threat to ecological resources or public safety.

There is the potential that vehicle traffic associated with implementing the proposed action will have a cumulative effect on traffic congestion. Measures to manage the time of day and week that project related vehicle trips occur are included in the project to minimize congestion, where possible. Under certain circumstances, however, vehicle travel associated with the action alternatives may be unable to avoid peak use periods and may add to already congested travel routes. This could negatively affect the experience of those recreation users driving for pleasure or those en route to a recreation destination

Alternative 3

Implementation of Alternative 3 would treat fewer overall acres of the landscape and would include more hand treatments compared to Alternative 2. The cumulative effects of implementing Alternative 3 would be the same as implementing the proposed action with the following exceptions:

As a result of implementing fewer acres of mechanical treatment, compared to the proposed action, there is likely to be less need for forest closures to protect public safety. While hand treatment operations may still require temporary closures, they are likely to be of a shorter duration and even more localized than those required during mechanical fuel reduction operations. There is still the potential that these closures, when combined with temporary closures associated with the Trail ATM work will have a negative effect on public access to dispersed recreation opportunities.

By reducing the acres of mechanical fuel treatment operations, compared to the proposed action, there will be fewer vehicle trips generated as a result of implementing Alternative 3. The trips that the project would generated would still have the potential to contribute to traffic congestion during peak use periods, which in turn could have a negative effect on recreation experiences that are dependent on vehicle travel on designated travel routes and highways.

O. Transportation

Scope of the Analysis, Indicators, and Issues

Scope

The transportation system plays a critical role in supporting project activities through providing access to, from, and within treatment units. The transportation analysis for this project is limited to the roads in the South Shore project analysis area. The temporal scope for analysis of the environmental effects of the transportation system includes short term (1-5 years) during project activities and long term (5+ years) following vegetation treatment. This timeframe would capture both the immediate effects of the South Shore project activities and extend to follow the expected impacts to the point where disturbed areas are stabilized. Environmental effects and measures to reduce the effect for landings are analyzed in the Water and Riparian, Soils, and Vegetation sections of this chapter.

The transportation system includes Forest Service System roads, existing temporary roads, temporary roads constructed solely for use by South Shore project activities, plus existing state, county and city roads and streets. This analysis covers Forest System roads, existing temporary roads, and the temporary roads constructed for use for the project.

Indicators and Issues

Environmental effects of the transportation system are dependent on miles of road, types of roads, the road surface, maintenance, and decommissioning. The items of concern for use of the transportation system include effects from ground disturbance, maintenance during project activities, and management of these routes at the completion of project activities.

Existing Conditions

There are 328 miles of State, County, City and Forest Service roads within the project area (see Table 3-121).

Table 3-121. Jurisdiction of roads within the project area (rounded to the nearest mile)

Jurisdiction	Miles
USFS	51 miles
El Dorado County	121 miles
City South Lake Tahoe	127 miles
State of California	29 miles
TOTAL	328 miles

The California Transportation Department manages and maintains the interstate highway system that provides access into and out of the project area. This system of highways provides a high degree of user comfort and mobility. Speed is controlled by speed limits and traffic congestion, vertical and horizontal alignments are seldom a factor in determining vehicle speeds. All of the state routes into the project area are double-lane paved roads.

El Dorado County manages and maintains a system of urban and rural roads within the project area. This system of roads provides access to homes, businesses and recreation sites from the State Highway system. These roads provide an adequate degree of user comfort and mobility. Speed is usually determined by local speed limits and occasionally by traffic congestion. There are several county roads within the project area where speeds are controlled by horizontal and vertical alignment as well as road width. The preponderance of the county transportation system consists of double-lane paved roads.

The city of South Lake Tahoe manages and maintains a system of streets linking homes and businesses to the state and county road network. User comfort and mobility is adequate for the intended use. Speeds are controlled by posted speed limits and prima facia speed laws. Horizontal and vertical alignments are not the limiting factor in determining speed. All city streets are paved and double-lane.

The US Forest Service manages and maintains a system of roads that links the forest user or administrator to the state, county and city network of roads and streets. User comfort and mobility are not the primary purpose of these roads. Speed is generally controlled by horizontal and vertical alignment as well as road width and surface type. The standard for roads within the project vary based on the purpose and need of the road. They can be categorized by maintenance level (ML).

The existing Forest Service road system in the South Shore project area is a combination of ML 1 (closed; basic custodial care; native surface); ML 2 (open; high vehicle clearance; native or improved native surface); ML 3 (open; suitable for passenger cars; native/gravel material or asphalt surface); and ML 4 (open; moderate user comfort; asphalt surface). Decommissioned roads (non-drivable) also occur and may be used during vegetation projects as temporary roads. In their current configuration ML 1, 2, 3 and 4 roads have stream crossings (perennial and intermittent) associated with them. In some cases, past road crossing restoration has occurred and involved changing undersized culverts with channel spanning bottomless arches or bridges (i.e. Trout Creek) In other cases, undersized culverts still exist and have restoration needs to provide fish passage and natural sediment transport (i.e. Spring Creek and Saxon Creek).

In 2001 and 2003 two road access travel management plans (ATM) were developed and implemented within the project area. The Powerline/Pioneer ATM decommissioned 6.17 miles of road, permanently closed 1.38 miles and treated the surface of 5.64 miles. The Camp Richardson/Emerald Bay ATM decommissioned 0.9 miles of road and converted 0.8 miles to non-motorized trail.

In an effort to reduce sediment from existing roads, BMPs were applied to all of the remaining Forest System roads. As a result, many of the ML 3 and 4 roads were surfaced. Native surfaces remained for ML 1 and 2 roads. On all maintenance levels new drainage crossings were installed, waterbars and dips were added, and both ditches and sediment basins were armored.

Direct and Indirect Environmental Consequences

To avoid redundant text and promote comparison between the action alternatives, they are discussed together in this section.

Alternative 1 (No Action)

Under the No Action alternative, none of the transportation activities for the South Shore project would occur. Therefore, there would be no direct effects from the project. Indirect effects would be limited to ongoing erosion and water quality effects from stream crossings that presently contribute to sediment or restrict flow and fish passage that would not be repaired or upgraded to implement the South Shore project.

Alternative 2 (Proposed Action) and Alternative 3

For both of the action alternatives, most of the project activities would be accomplished on the existing permanent road system. No new permanent roads would be constructed under either Alternative 2 or 3. A total of approximately 112 miles of all types of roads of all jurisdictions would be needed for the South Shore project in alternative 2, and 108 miles of road in all jurisdictions in Alternative 3.

For both action alternatives, the Forest Service would use 3.90 miles of City of South Lake Tahoe streets. There would be no negative environmental effects because there would not be a need to improve or reconstruct any of these streets. The City may require rocking or stabilization of the access road to prevent tracking of debris and soil onto the City streets, which would prevent effects from soil or debris being carried down streets in a storm event. The BMPs which would be installed to prevent migration of debris and soil into the waters of the State would also mitigate environmental effects. These intersections would be temporary in nature, and be blocked or obliterated upon completion of the project.

There are approximately 38 miles of El Dorado County roads that would be utilized for both action alternatives. As with the City roads, there would be no negative environmental effects because there would not be a need to improve or reconstruct any of these roads. The County may require rocking or stabilization of the access road to prevent tracking of debris and soil onto the County roads, which would prevent effects from soil or debris being carried down roads during a storm event. There is a potential for some Forest Service roads to be expanded or improved at existing intersections to accommodate the equipment and vehicles that would be used for project activities. The BMPs which would be installed to prevent migration of debris and soil would also mitigate these environmental effects.

Total Forest Service road miles that would be used varies by alternative, although The 26.7 miles of Forest Service roads where road maintenance would occur remain the same under both action alternatives. The differences between alternatives for road effects occur on temporary and spur roads that would require reconstruction in order to accommodate the vehicles and equipment that would be used. Total miles of reconstruction for Alternative 2 would be approximately 15 miles, while Alternative 3 would reduce needed road reconstruction to approximately 11 miles. Temporary roads and spur roads would account for approximately eight percent of the total road mileage that would be used for the project. The roads to be reconstructed within the project area are either maintenance level 1 or 2. Although Level 1 and 2 roads are managed differently, the reconstruction, monitoring, restoration, and effects are much the same.

The use of existing road prisms to provide approximately two-thirds (10.3 miles) of the temporary roads needed would reduce impacts from the reconstruction that would be required. A new temporary road under Alternative 2 would require construction (estimated 4.8 miles). Reconstruction or construction of temporary roads may include the removal of trees larger than 30 inches dbh.

Most of the needed reconstruction is associated with the need to remove vegetation from existing roads that have become overgrown. Reconstruction would also include repairing the running surface, environmental impacts would be reduced by adding aggregate base to reduce the loss of native surface material. Additional road reconstruction activities that would reduce the impacts from roads involve the replacement of inadequate drainage crossing, elimination of ruts, ditch repair, and installation of waterbars and dips to provide adequate runoff. The majority of roads scheduled for reconstruction is located on gentle side slopes with cuts and fill less than three feet. There are two roads that exceed these cut and fill heights, however, in both cases, the existing slopes would not be disturbed.

New temporary roads would require construction that differs from road reconstruction primarily by the need to create a corridor through the forest. Road construction would reasonably be predicted to require the removal of larger trees (i.e., mid-story or overstory co-dominant trees) more frequently than temporary road reconstruction. Removal of dominant canopy trees is anticipated to be generally avoided as the main objective of the project is to remove smaller trees and retain larger trees.

Several temporary stream crossings are proposed for South Shore project implementation. The number of stream crossings and the type of channel that would be crossed are discussed further in the Water and Riparian Resources section of this chapter. In total, there would be 28 temporary crossings on ephemeral channels, and one on an intermittent channel in the project area. Culverts and stream crossings on temporary roads for this project would be installed to prevent obstruction of water flow and fish passage. Effects from crossings on ephemeral channels would be reduced by installation when the channels are dry; the use of Humboldt crossings or another acceptable crossing type; and removal prior to any precipitation event and before the winter season begins. Installation and removal of the temporary crossings may result in soil displacement and loosening which could lead to a short-term increase in sediment delivery to downstream reaches under both action alternatives. However, because all but one of the temporary crossings proposed with this project are on ephemeral drainages that would be constructed and removed when the channels are dry, no substantial effects from these temporary stream crossings are expected as a result of project activities.

A single temporary crossing on an intermittent channel in the Saxon Creek watershed would need to stay in the channel over winter in both action alternatives. Specific installation criteria would reduce effects to water quality. A filter fabric would be installed first, for ease of removal and to prevent loss of fill material to downstream areas. Then, a culvert would be installed of sufficient size to pass the winter and spring flows without causing accelerated flow downstream (approximately 18-24” diameter). Finally, rock would be used instead of dirt to fill in behind the culvert, again for ease of removal and to prevent sediment delivery to downstream areas. These measures are expected to protect surface water quality from being degraded by installation and removal of the crossing. Therefore, effects from this temporary stream crossing are not expected as a result of project activities.

Both Alternative 2 and 3 would require construction of a permanent improvement to an existing crossing on Forest Service system road 12N01A over an intermittent tributary to Saxon Creek. The existing low-water crossing on this intermittent channel is acting as a flood passage barrier and has caused aggradation upstream. The proposed new channel crossing would be designed to pass the 100-year flood event. The proposed crossing design would improve the conditions in this intermittent channel, and better connect the upstream and downstream portions of the channel and meadow. Substantial excavation in the floodplain would be required to remove the existing fill and to construct the foundation of the road crossing to support hauling trucks. The removed fill would be replaced with an improved design which would no longer restrict flood flows. The crossing would be constructed in the fall, during drier channel and meadow conditions to prevent direct impacts to this tributary or to Saxon Creek. Although short-term impacts are likely from removing fill in the floodplain, and the potential for construction impacts exists, the long-term result of replacing this stream crossing would be beneficial to the stream and the associated floodplain.

In the Osgood Swamp watershed, an existing crossing on Forest Service system road 12N20 at the end of Nez Pierce Street has a vented ford with crushed pipes that is no longer functioning and is too narrow to allow equipment to cross without causing resource damage. Currently, this crossing is causing upstream aggradation and preventing fish passage. Replacement of this crossing would improve flow of this spring-fed perennial stream, correct aggradation upstream, and allow fish passage to resume. Although short-term impacts are likely from removal of the old crossing, and the potential exists for construction impacts, the long-term result of replacing this stream crossing will be beneficial to the stream, the fisheries, and the associated floodplain.

Decommissioning temporary roads after project implementation would also reduce ongoing road impacts under both action alternatives.

Cumulative Impacts

Alternative 1 (No Action)

Under the No Action alternative, there would be no activities; therefore there would be no impacts from road maintenance, construction, or reconstruction. No road surfaces would be improved and existing stream crossings causing upstream aggradation, blockage of water flow, or preventing fish passage would continue in their existing conditions.

Alternative 2 (Proposed Action) and Alternative 3

Cumulative effects are similar for both action alternatives; therefore they are discussed together to reduce redundant text and provide a convenient comparison of differences between alternatives where they exist. A list of past, present, and reasonably foreseeable actions is found in Appendix A. The effects of activities related to the transportation in the South Shore project would add to ongoing effects in the project area. The majority of the added South Shore project effects would be short-term, and occur during the 5-8 years of project implementation. Road maintenance and reconstruction would create ground disturbance that would be additive to other ongoing activities from other projects on both federal and private ownerships. Initial activities to maintain or create road surfaces would increase the potential for sediment transport, while improvements to both existing road surfaces and existing stream crossings would reduce the potential for sediment transport. The net effect is likely to be neutral or positive over the longer term, because the improvements to road surface and stream crossings would be permanent, and the decommissioning and stabilization of temporary roads would reduce the potential for ongoing effects from these roads. Both action alternatives would improve the same stream crossings. Because Alternative 2 would call for approximately 4 more miles of temporary road mileage than Alternative 3, road impacts and cumulative impacts would be less for Alternative 3.

Social and Economic Conditions and Effects

This section provides the methodology and analytical basis for the economic comparison of alternatives. The values used in the analysis are approximate and discounted to 2008 dollars. When applied consistently throughout the analysis, they give a relative value to compare the alternatives. These values are not intended to be a precise measure of an alternative's economic effect.

Analysis Methods

The economic efficiency of the alternatives was analyzed using the present net value (PNV) of revenues and costs anticipated during the life of the project. Present net value can be viewed as the lump sum of money the decision maker would have in hand as a result of committing forest resources to a particular alternative.

Present net value is used as an indicator of economic efficiency and is used in conjunction with other factors in the decision-making process. Present net value combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity occurring in a single year. Economic impacts are displayed as cost and revenue estimated to result from implementation of each alternative.

Environmental Effects

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Project planning costs are sunk costs incurred initially because they are incurred regardless of the alternative selected. Planning costs for the project is estimated at $2,220,000 for all alternatives. This alternative proposes no action and produces no economic outputs. No thinning, road management, or monitoring activities would occur. No market benefits, (direct, indirect or non-quantifiable) can be attributed to this alternative. Implementation of the No Action alternative will not provide additional public benefits to local jobs or income generated from the forest products industry.

Alternative 2 – The Proposed Action

Direct Effects

Costs and Revenues associated with all Alternatives are displayed in Table 3-122. Values in Table 3-122 are expressed in current day dollars. Present net values are discussed below and are summarized in Table 3-123. Activity Revenues are the estimated value of wood fiber that would be removed from the project as a result of implementing thinning treatments. Revenues would be collected in the form of stumpage paid by contractors for both sawtimber size material (generally trees larger than 10 inches dbh), and biomass material (generally trees between 3 and 10 inches dbh). Alternative 2 would generate an estimated $9,226,000 in revenues. Costs for each alternative outlined below include all dollars that would be expended to plan and implement the alternatives. Total cost for Alternative 2 is estimated at $13,062,000.

Table 3-123 shows the total present value costs for each Alternative. Present value revenues for Alternative 2 are estimated to be $8,899,000. Revenue generated from the sale of commercial timber is a direct benefit. Alternative 2 would remove an estimated 2,948 hundred cubic feet (CCF) of wood fiber in the form of both sawlogs and biomass. Present value cost was estimated to be $12,233,000. The present net value for Alternative 2 was estimated at $-3,334,000 and a benefit-cost ratio of 0.73, which indicates that the project costs would exceed the value of the commercial timber. As this alternative produces revenues from thinning only, values generated from the sale of generally smaller trees would not cover the costs associated with tree removal and extensive slash cleanup from past tree mortality.

Table 3-122. Costs and revenues for the South Shore project by alternative

Costs / Revenues, 2008 Dollars	Alternative 1 - No Action	Alternative 2 - Proposed Action	Alternative 3
Revenues			
Value of wood fiber included in contracts	$0	$9,226,000	$7,196,000
Costs			
Administrative costs, project preparation and contract administration	$0	$774,000	$738,000
Mechanical Thin	$0	$3,358,000	$5,675,000
Hand Thin and Pile	$0	$4,461,000	$5,124,000
Masticate/Chip Fuels	$0	$1,652,000	$1,822,000
Pile Burning	$0	$2,384,000	$2,744,000
Prescribed Underburn	$0	$276,000	$272,000
Temporary Roads	$0	$89,000	$73,000
Road Reconstruction	$0	$68,000	$60,000
Cost Total	$0.00	$13,062,000.00	$16,508,000.00

Source: South Shore Fuels Reduction and Healthy Forest Restoration Project Economic Spreadsheet

Table 3-123. Present value costs, revenue, net value and benefit-cost ratio by alternative

Alternative	Present Value Costs	Present Value Revenue	Present Net Value	Benefit-Cost Ratio
Alternative 1 - No Action	$0	$0	$0	0.00
Alternative 2 - Proposed Action	$12,233,000	$8,899,000	$-3,334,000	0.73
Alternative 3	$15,616,000	$6,942,000	$-8,674,000	0.44

Source: South Shore Fuels Reduction and Healthy Forest Restoration Project Economic Spreadsheet

Indirect Effects Foreseeable Future Actions

Indirect effects of Alternative 2 are additional public benefits such as local employment, income generated from the forest products industry, and energy from local cogeneration plants. Based on relationships between employment and harvest in northwest California for 1994 each million board feet of sawtimber harvested supported 22.3 year round jobs in timber industry employment (Raettig 1999). Assuming the relationship of sawtimber harvested to employment in northwest California is similar to central and northern California. Table 3-124 displays the predicted total full time jobs and associated employee-related income resulting for each alternative. Alternative 2 would create an estimated 25 full time jobs for timber industry employment. Based on a medium income of $70,516 for El Dorado County residents (US Census 2000, adjusted to 2006), the total employee related income for Alternative 2 would be $1,762,900.

Table 3-124. Comparison of employment related effects

Alternative	Total Full-time Jobs	Total Employee Related Income
Alternative 1 - No Action	0	$0
Alternative 2 - Proposed Action	25	$1,762,900
Alternative 3	21	$1,481,000

Cumulative Effects

The cumulative effects of this project would include the maintenance costs associated with the various treatments. Maintenance of treatments within the defense zone of the wildland urban interface is estimated to cost $13,956,000. These treatments would occur in twenty years and would consist of thinning or understory burning where understory trees have regenerated causing live fuel build up in the form of fire ladders. The projected cumulative impacts of this project when combined with other projects would be to further increase employment and contracts to accomplish such work.

Alternative 3

Direct Effects

Costs and revenues associated with Alternative 3 are displayed in Table 3-122. Alternative 3 would generate an estimated $7,196,000 in revenues. Total cost for Alternative 3 is estimated at $16,508,000. Table 3-123 shows the total present value costs. The present value cost for Alternative 3 is estimated to be $15,616,000. Revenue generated from the sale of commercial timber is a direct benefit. Alternative 3 would remove an estimated 2,533 CCF of wood fiber in the form of both sawlogs and biomass. Present value revenue was estimated to be $6,942,000. The present net value for Alternative 3 was estimated at $-8,674,000 and a benefit-cost ratio of 0.44, which indicates that project costs would exceed the value of the commercial timber. As this alternative also produces revenues from thinning only, values generated from the sale of generally smaller trees would not cover the costs associated with tree removal and extensive slash cleanup from past tree mortality. Alternative 3 would utilize more cut-to-length harvesting over whole tree harvesting than in Alternative 2. Cut-to-length harvesting systems are more expensive than whole tree systems and with less acres of mechanical harvesting stands in Alternative 3 than Alternative 2, the ratio of costs to revenues is higher in Alternative 3.

Indirect Effects

Indirect effects of Alternative 3 are similar to those discussed for Alternative 2. Table 3-124 displays the predicted total full time jobs and associated employee-related income resulting for Alternative 3. Alternative 3 would create an estimated 21 full time jobs for direct and induced employment. The total employee related income for Alternative 3 would be $1,481,000.

Cumulative Effects

The cumulative effects of Alternative 3 would be the same as those described for Alternative 2. Maintenance of treatments within the defense zone of the wildland urban interface is estimated to cost $12,310,000. These treatments would also occur in twenty years and would consist of thinning or understory burning, where understory trees have regenerated causing live fuel build up in the form of fire ladders.

Environmental Justice

Scope of the Analysis, Indicators, and Issues

Executive Order 12898 requires that all federal actions consider potentially disproportionate effects on minority and low-income communities especially if adverse effects to environmental or human health conditions are identified.

Direct, Indirect, and Cumulative Environmental Consequences

Adverse environmental or human health conditions created by any of the alternatives would not affect any minority or low income neighborhood disproportionately.

The activities proposed in all alternatives were based solely on the existing and desired condition of the vegetation, sensitivity of the environment, and practical treatment access in response to the Purpose and Need. In no case was the treatment prescription design based on the demographic makeup, occupancy, property value, income level or any other criteria reflecting the status of adjacent non-federal land. Federally owned lands proposed for treatment are distributed throughout the project area, and are intermixed with non-federal lands. Reviewing the location of the proposed treatments in any of the alternatives in relationship to non-federal land, there is no evidence to suggest that any minority or low income neighborhood would be affected disproportionately. Conversely there is no evidence that any individual, group or portion of the community would benefit unequally from any of the actions in either of the action alternatives.

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).

For Alternatives 2 and 3, short-term activities in the South Shore project area environment to reduce levels of hazardous fuels would also enhance long-term productivity by reducing the risk of long-term effects from high intensity wildfire. Thinning and preferential retention of Jeffery/ponderosa and sugar pines will created soil disturbance in the short-term, but result in a healthier forest with a mix of forest species with improved resistance to fire, drought, insects, and disease. In order to meet the purpose and need for fuel reduction and a healthier forest ground disturbance would increase impacts to watersheds for the short-term. However, watersheds are expected to recover over the long-term, without a loss in long-term productivity. Short term effects are expected to be greater in Alternative 2 because activities would occur on more acres in Alternative 2. In a comparative analysis of impacts to watersheds between fuel reduction treatments and wildfire, holding the acreage constant, impacts were greater by an average factor of 3 for a low to moderate intensity wildfire and greater by an average factor of 5 for a moderate to high intensity wildfire.

Unavoidable Adverse Effects

Implementation of any alternative would result in some unavoidable adverse environmental effects. Although formation of the alternatives includes design features to reduce or avoid some potential adverse effects, some adverse effects could occur that cannot be completely mitigated. The environmental consequences section for each resource area discusses these effects and they are summarized below.

Fire hazard and resistance to control would increase over time under the No Action alternative. Smoke from underburning and pile burning, along with dust and exhaust from heavy equipment and trucks would be created under both Alternative 2 and Alternative 3. Emissions would comply with state and local air quality rules and regulations. The Fire and Fuels section and Air Quality section above discuss and compare these effects among alternatives. Some soil compaction could occur in mechanical treatment units, although rehabilitation of skid trails and landings would reduce these effects. Unknown occurrences of sensitive or special interest plants could be damaged or destroyed by treatment activities associated with both action alternatives although this would be mitigated by surveys and flagging for avoidance and would not result in a loss of viability for any species.

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

Under both action alternatives, there would be an irreversible loss of the particular trees removed from the project area. However, the site productivity would remain, and new seedlings would become established over time. No other irreversible commitments of resources are anticipated.

New construction of a section of temporary road under Alternative 2 would be an irretrievable commitment for the period of time when the road is used. Temporary road reconstruction and maintenance represent irretrievable commitments for the period of time the roads are used, although temporary roads would be decommissioned following use, which would restore the productivity of the site and the designated use of the route. Compaction associated with mechanical equipment is an irretrievable commitment of soil resources that would ameliorate with time. The levels of compaction anticipated are within the Forest Service Region 5 soil quality standards. Removal of snags and down logs under Alternatives 2 and 3 would be an irreversible loss of habitat for wildlife dependent on cavities or down logs for feeding and/or nesting/denning, although retention of snags and down logs would meets Forest Plan guidelines. The magnitude of this effect is greater for Alternative 2 verses Alternative 3 because more acres are affected by Alternative 2. This effect is discussed in the terrestrial wildlife section above

Chapter 4

Monitoring

This chapter describes the monitoring that would be required for the South Shore project. The purpose of project monitoring is to track the implementation of the design features found in Chapter 2 and the prescribed BMPs (Appendix C), and in some cases, to measure their short-term effectiveness at protecting resources.

Types of Monitoring

Implementation monitoring consists of visual monitoring of project treatment areas, roads, stream crossings, landings, etc., to ensure that all management practices and design features are implemented, including those designed to prevent sediment delivery and protect water quality (e.g., erosion control measures, riparian buffers, waterbars, critical dips) are in place as prescribed.

Effectiveness monitoring consists of visual monitoring to evaluate the effectiveness of the prescribed design features and management practices at meeting their objectives. It includes evaluating the effectiveness of management practices designed to prevent sediment delivery and protect water quality (e.g., erosion control measures, riparian buffers, waterbars, critical dips).

Organization of Chapter 4

Chapter 4 describes the monitoring that is required specific to the South Shore project. A discussion of differences between alternatives is organized by resource area and described when there would be a change in required monitoring based on a difference between the action alternatives. The monitoring requirements are separated into specific resource areas for ease in reading in the following order:

- Soil, Water and Riparian Resources Monitoring
- Aquatic Resources Monitoring
- Transportation Monitoring
- Sensitive Plant Monitoring
- Invasive Weed Monitoring

The best management practices (BMPs) referred to in the following discussion are found in Appendix C, with a short description.

Soil, Water and Riparian Resources

Required Monitoring

<u>Soil Moisture</u>

Monitoring soil moisture would be used to determine when soil conditions are suitable for mechanical equipment operations, in order to avoid detrimental compaction. Soil moisture conditions are required to be relatively dry for mechanical treatment operations. In all SEZ mechanical treatment units, and where soil moisture conditions are in question in upland stands, moisture determinations would be made immediately prior to implementation using the protocol presented on the first page of the SEZ sensitivity rating system in Appendix D.

SEZ Pile Burning

The design features (Chapter 2) for pile burning in SEZs under both action alternatives are new to the Lake Tahoe Basin, and their effectiveness at protecting soil and water quality in SEZs has not been quantified. For the first two years after piles are burned, monitoring would be used to determine whether the design criteria were successful in avoiding significant impacts to soil stability, soil productivity and riparian plant growth: Transects would be established through burn pile units before the piles are burned to measure average pile size, average pile spacing, and average fuel size within the piles. Monitoring after piles are burned would include: soil hydrophobicity both outside the pile and within the burn footprint, transport distance of burned or unburned material from the pile, vegetation cover, and plant species composition. Results from this monitoring would be used to either support the current design features, or to modify them to provide additional protection to SEZs.

BMP and Design Feature Implementation

Implementation monitoring would occur in each treatment unit, as well as other areas affected by the South Shore project such as access roads, staging areas, water supply areas, etc. This would include completing a checklist that contains BMPs and design features contained in the NEPA and contract documents that apply to soil and water quality protection. The checklist would require visits to the treatment stands before, during and after implementation to ensure that all BMPs and design features are carried out on the ground as they were prescribed. An example of the implementation checklist is attached as Appendix D.

BMP Evaluation Program

Best management practice evaluation program (BMPEP) protocols developed by the USFS and D (USDA FS 2002) would be followed to provide qualitative information about whether BMPs are implemented as prescribed in the NEPA document (and subsequent contract and permit requirements and specifications) and that they are effective in protecting soil and water resources. Regionally, targets are set for each forest (including the LTBMU) identifying how many of each type of evaluation should be completed each year. The South Shore proposed treatment units and roads would be included in the pool for random BMPEP evaluations to meet this target. The BMPEP monitoring fulfills forensic monitoring requirements.

Additional Monitoring Based on CWE Analysis Results

Several triggers have been agreed to by the LTBMU and Lahontan Water Board staff for additional monitoring requirements based on the results of the CWE analysis (discussed in more detail in the CWE section of Chapter 3). These triggers include: 1) an increase in RR of 20% or more in watersheds not over the TOC, 2) an increase in RR of 5% or more in watersheds that are over the TOC, and 3) an ERA increasing above the TOC due to project activities.

With the Alternative 2 proposed treatments, two watersheds exhibited an increase in RR over the course of the project of more than 20% (Tallac Creek (25.7%) and Taylor Creek (25.2%)). These watersheds would require additional monitoring to ensure that watershed effects are avoided under the Alternative 2 scenario. The additional monitoring would include extra BMPEP evaluations beyond those required to meet the regional targets in stands adjacent to streamside management zones and at stream crossings (Protocols T01 and E09, respectively). The T01 protocol would be followed at every streamside management zone present within treatment stands in these watersheds prior to implementation and after treatments are complete. The E09 protocol would be followed at up to 5 stream crossings within the watershed treatment stands after the first major storm event (1 inch, 24 hour storm) and after spring runoff the year after treatments. BMPEP evaluations would be repeated only if deficiencies are documented that result in a “not implemented” or “not effective” rating. Photos would be taken for documentation of “not effective” ratings. Corrective actions would be prescribed as necessary to correct documented deficiencies, and repeat evaluations would be conducted until deficiencies have been corrected.

In addition, the Camp Richardson Frontal HUC7 watershed was already over the TOC prior to applying project treatments, and exhibited an increase in RR of more than 5% with both Alternatives 2 and 3. Because the Camp Richardson Frontal watershed meets the criteria for the second trigger mentioned above, additional monitoring would be required in this watershed under both Alternative 2 and Alternative 3. Again, this would include more intensive project level BMPEP evaluations in the Camp Richardson watershed for the streamside management zones (T01) and stream crossings (E09). These protocols would be implemented as described in the paragraph above.

Aquatic Resources

Required Monitoring

Stream Temperature and Shade

The objective of fuel treatments in SEZs (along or adjacent to perennial flowing tributaries) is to have no measurable increase in stream temperature as a by-product of conifer removal. Therefore, the critical monitoring question is, would the decrease in density of live conifers result in a decrease in stream shade and a measurable increase in stream temperature? Monitoring parameters would include: a) selection of a minimum of 4 SEZ treatments, b) installation of 3 temperature loggers at each unit, c) temperature monitoring locations above, within and below each selected unit and d) measurement of stream shade at each temperature monitoring location.

Transportation

Required Monitoring

The mechanism for monitoring and documenting the implementation of transportation design features and BMPs will be the implementation monitoring checklist, previously described under the Soils, Water, and Riparian Resource section. An example implementation checklist is provided as Appendix D. Specific implementation monitoring elements related to transportation are also detailed below.

Storm Water Pollution Prevention Program

The storm water pollution prevention program (SWPPP) practices and features would be incorporated into the specifications for road design on each road that is constructed or reconstructed as well as all stream crossings. It is not included at this time, it will be provided later as part of the roads package. Inspections or monitoring of the SWPPP practices would be done by Forest Service personnel or a qualified contractor.

During the summer, SWPPP inspections are made once a month, before forecasted storms when possible, and after a storm. A storm lasting more than 24 hours requires an additional inspection during the storm, when access and safety for personnel allows. If safety or access concerns prevent inspection during a storm, the inspection would occur as soon as access allows and conditions are safe for accomplishment of the inspection. If the SWPPP design is not working as planned, changes would be made in the field to correct the problem and those changes would be recorded on the SWPPP drawings with copies sent to permitting agencies. Copies of all inspections are kept along with the SWPPP drawings.

Construction and Reconstruction

- Inspect construction and reconstruction as it is occurring to insure that BMPs are implemented according to the site-specific requirements for individual roads.

Drainage

- Insure that drainage structures are installed per contract BMPs, and continue to monitor functioning of drainage structures after storm events producing 1 inch or more precipitation, during spring runoff, and at the end of each season of use.
- If the above monitoring indicates a need, maintain all drainage structures during the season of use and as needed to protect soil and water quality over the winter.

Over Snow Use

- Monitor that snow depth and compaction are adequate for operations without damage to soils, as per design features in Chapter 2 and BMPs.
- Implement BMPs to prepare roads for over-snow use and insure that snow removal does not damage road surfaces or drainage structures; inspect when snow removal occurs.

Maintenance

- Monitor maintenance needs as it relates to water, soil, and air, while protecting the road investment. Inspect roads during every operation period during active use for the project.
- Include all project roads in the BMPEP random pool for implementation and effectiveness evaluations.
- Monitor winter closures of roads used by the South Shore project to assure that closure devices are adequate and effective. Forest Service roads (system and temporary) have date certain closures, specific to the road. These closures begin between November 15 and November 30, with roads at higher elevations generally closing earlier than roads at lower elevations. Lack of evidence of tire tracks in snow or mud on closed roads after the closure date would indicate that closures are effective and adequate. If tire tracks in mud or snow are present after the closure date, corrective action would be taken.
- Monitor maintenance needs for roads to be used by the South Shore project annually in the spring before operations begin. Roads would have dates for opening dependent on weather and snow pack conditions, with roads generally opening earlier at lower elevations and later at higher elevations. Needed maintenance would be accomplished before use for project activities.

Post Project

- Assure that all system roads return to their original use, adequate for the user groups intended in the ATM after project implementation and use of each road is completed.
- Assure that all non-system roads are decommissioned and blocked from unauthorized use after project implementation and use of each road is completed.

- Monitor a random sample of roads, landings, and skid trails used by the project to ensure prescribed stabilization measures remain effective at the completion of the project, through the BMPEP monitoring program previously described in the Soil, Water, and Riparian section. BMPEP sites would be selected through random selection for regional targets, as well as the additional stream crossing evaluations (E09) based on CWE analysis.
    - Monitoring would occur during the first year post implementation of stabilization measures, (after one major storm event and/or the first period of spring runoff). For sites that receive a score of “Not Effective” with corrective action recommended, follow-up monitoring would continue until the problem is resolved. If the score is rated as “Effective” but the evaluator noted an item recommended for follow-up evaluation, monitoring would be done the following year to evaluate whether there are any ongoing deficiencies in need of correction.
    - Where revegetation has been done, monitor revegetation success for decommissioned roads and landings 2 years after revegetation occurs. If monitoring indicates that the area is not stable or ground cover is inadequate to prevent erosion (i.e. less than 75% ground cover is present in the form of organic material and live vegetation), additional mitigation measures would be applied as needed.

Sensitive Plants

Required Monitoring

Sensitive plant surveys have been completed for the South Shore project treatment units. Monitoring would occur during project implementation to avoid impacts to sensitive plant locations.

- LTBMU botanists would be notified prior to project implementation activities in order to insure sensitive plant areas are flagged in accordance with the design criteria (Chapter 2).
- If any new sensitive plants or sensitive plant communities are discovered during project implementation an LTBMU botanist would be notified so they can be flagged as above.
- For units containing fen areas, LTBMU botanists would be on site to monitor implementation of design features to protect these features and their plant communities.
- Sensitive plant and fen areas would be monitored post implementation to determine effectiveness of design criteria.

Sensitive fungi potential habitat would be monitored in two units of the South Shore project area. Monitoring of the one-acre permanent fungi monitoring plot locations established within these stands before project implementation would consist of the following:

- LTBMU Botanists would be notified prior to any project implementation activity to check that flagging for monitoring plots are in place.
- If sensitive fungi are found in these monitoring plots within the project area, an additional buffer would be established to maintain existing habitat conditions, following the design criteria given in the BE for sensitive plants.

- Fungi monitoring plots will be monitored post implementation to determine the effectiveness of design criteria and any potential impacts.

Invasive Weeds

Required Monitoring

LTBMU noxious weed coordinator would be notified prior to project implementation activities in order to ensure that existing noxious weed infestations are treated or flagged in accordance with the design criteria (Chapter 2).

After the project is completed for each year of ongoing implementation, the LTBMU noxious weed coordinator would be notified as to the treatments units where activities occurred that year. The LTBMU noxious weed coordinator would inventory the high risk areas (e.g. roads and landings) within the project footprint after project implementation to enable actions to ensure additional weed species do not become established in the areas affected by the project and to ensure that known weeds do not spread. All noxious weed infestations within the project footprint would be monitored and treated post implementation for 3 years or until eradicated.

Manual methods would be utilized to control noxious weeds. Manual control methods include hand-pulling, weed wrench, cutting/lopping, digging, grubbing, hoeing, removal of flower heads or seed pods.

Implementation of noxious weed prevention practices would be monitored in compliance with the state and SNFPA (2004) standards. Require washing equipment before entering the project area when: equipment is coming from outside the Lake Tahoe Basin; if the previous location is unknown; or the previous location is infested with weeds. Equipment would be inspected after washing to insure the absence of soil, seeds, or plant materials.

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Consultation

The following individuals, federal, state, and local agencies, and tribes were consulted during the development of this EIS.

Washoe Tribe of Nevada and California
The City of South Lake Tahoe Fire Department
Lake Valley Fire Protection District
Tahoe Douglas Fire Protection District
Fallen Leaf Fire Department
Lahontan Water Board
Tahoe Regional Planning Agency (TRPA)

Acronyms

CAR critical aquatic refuge: Forest Plan land allocation from the Sierra Nevada Forest Plan Amendment to designate areas for management emphasis on aquatic resources.

CTL cut to length: Method of thinning using mechanical equipment that cuts trees to length and removes branches and tops before they are moved to a landing. Operates on top of the bed of slash created by the removed branches and tops.

EIS Environmental Impact Statement: The document required by the NEPA for disclosing to the public the activities and effects of an action by a federal agency.

ERA equivalent roaded acres: Used to estimate the impacts of various land use activities in a watershed. The ERA method relates the relative magnitude of disturbance from land use activities compared to an acre of road disturbance. Land uses are assigned a coefficient based on relative impact, ranging from 1.0 for roads, structures, and other impervious surfaces to 0.0 for land uses that have a negligible or positive impact on the soil hydrologic properties.

HRCA home range core area: Approximately 1000 acre area designated by the SNFPA as the area surrounding the PAC to be maintained as foraging and PAC replacement habitat for CA spotted owls.

HUC hydrologic unit code: Designation by the United States Geologic Survey (USGS) that labels watersheds based on their relative size from 1 being major river systems to 12 being very small subwatersheds of only a few acres.

LWD large woody debris: Material usually 12 inches or larger in diameter within stream channels or floodplains. Provides fish habitat and floodplain roughness.

ML maintenance level: Roads are classified into maintenance levels 1-5 depending on the use of the road. Level 1 roads are project roads generally closed to public access, while level 5 roads are paved two-land roads accessible by passenger cars for public use.

NEPA National Environmental Policy Act: Law that requires federal agencies to disclose major actions and their environmental consequences to the public.

PAC protected activity center: Approximately 300 acre area designated by the SNFPA centered on a nest tree to be managed as nesting habitat for CA spotted owls.

RCA- riparian conservation area: A buffer for streams, special aquatic features and other hydrological depressions as defined by the Sierra Nevada Forest Plan Amendment (SNFPA)

RR Risk Ratio: The total ERA from all land uses in each watershed is compared to TOC for that watershed in order to define the risk ratio using the following equation: Risk Ratio = ERA/TOC

ROD record of decision: The decision document for an EIS.

SEZ- stream environment zone: Biological communities, as defined by TRPA and the Lahontan Water Board, that owe their characteristics to the presence of surface water or a seasonally high groundwater table. The criterion for defining SEZs includes indicators of vegetation, hydrology, and/or soil type (WQCP 1995).

SNFPA Sierra Nevada Forest Plan Amendment: Amendment to the Forest Plans of 11 national forests in the Sierra Nevada mountain range, including the LTBMU.

SPLAT strategically placed area treatment: Fuel reduction treatments placed in a pattern to interrupt fire progression such that the fire reduces in intensity and becomes a surface fire in these areas. The overall pattern impedes fire spread.

TOC Threshold of Concern: Watersheds have a natural sensitivity, or threshold, to absorb disturbance, human or natural, specific to geology, soil, and slope.

WT whole tree: Mechanical method of thinning where the entire tree is moved to a landing for further processing to remove limbs and tops after it is cut.

WUI wildland urban interface (intermix): Where homes, businesses, and/or communities are juxtaposed with public lands. The SNFPA defines the WUI as 3 zones: the urban core where undeveloped public and developed private lands are adjacent; the defense zone where undeveloped public lands extend ¼ mile from places where people live and/or work; and the threat zone where undeveloped public lands extend 1.5 miles from places where people live and/or work.

Glossary

backing fire	A fire spreading, or ignited to spread, into (against) the wind, in the absence of wind, or downslope.
bog	A wet, poorly drained, highly acid, nutrient poor, peat-accumulating wetland with surface vegetation of acidophilic mosses (particularly Sphagnum) and possibly some shrubs or trees.
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.
endlining	Moving logs using cables where the log is in full or partial contact with the ground
fen	A peat accumulating wetland that receives some drainage from surrounding mineral soils and usually supports marshlike vegetation including sedges, rushes, shrubs, and trees. Fens are less acidic than bogs, and derive most of their water from groundwater rich in calcium and magnesium.
flag and avoid	The hanging of flagging in order to identify for the purpose of avoidance of a special feature in an area.
hot piling	Placing and consolidating unburned fuel into an already burning pile for the purpose of isolating or localizing a prescribed fire.
hydrophobicity	Resistance to water absorption by severely burned soils.
intermittent stream	A stream or portion of a stream, that does not flow year-round but only when it (a) receives base flow solely during wet periods, or (b) receives groundwater discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources
lacustrine	Lake ecosystem; includes the lake and lake shore.
lentic	Stream ecosystem; includes the stream and stream bank.
mastication	A process to manipulate fuels or biomass (trees, thinning slash, shrubs, etc.) from a larger size to a smaller size.
mesic	Of sites or habitats characterized by intermediate moisture conditions, i.e., neither decidedly wet nor dry.
perennial stream	A creek or river that flows all year (see intermittent and ephemeral).
prescription	Direction given for land and resource management in a given area.

ripping- A process to mitigate soil compaction. Using equipment with a toothed blade or set of heavy tines mounted at the front or rear of the equipment to break up hard ground or to tear out stumps and boulders; can be synonymous with subsoiling and tilling.

riverine Pertaining to rivers and river bank environments.

treatment A specified method for the purpose of reaching or bringing land and/or resource conditions towards a desired condition or goal.

underburn Fire in the forest understory; a prescribed or wildfire that consumes surface fuels but not trees

vernal pool A contained basin depression lacking a permanent above ground outlet. An ephemeral (temporary) pool that fills with snowmelt and spring run-off.

References Cited

Agee, J.K. 1993. Fire ecology of the Pacific Northwest forests. Island Press. Washington D.C.: 25-52.

Agee, J.K. 1996. The influence of forest structure on fire behavior. *In* Proceedings, 17th annual Forest Vegetation Management Conference. Redding, CA. January 16-18, 1996: 52-68.

Agee, J.K., B. Bahro, M.A.Finney, P.N. Omi, D.B. Sapsis, C.N. Skinner, J.W. van Wagtendonk, C.P. Weatherspoon. 2000. The use of shaded fuelbreaks in landscape fire management. Forest Ecology and Management 127:55-66.

Allen, A.W. 1987. The relationship between habitat and furbearers. Pages 164-179 *In:* M. Novak, J.A. Baker, M.E. Obbard, and B. Mallock, eds. Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resources, Canada. 1150 p.

Alexander, M.E. 1988. Help with making crown fire assessments. *In* W.C. Fisher and S.F. Arno, comps. Protecting people and homes from wildfire in the interior West: Proceedings of the symposium and workshop; 1987 October 6-8; Missoula Montana. Gen. Tech. Rep. GTR-INT-251. Intermountain Forest and Range Experiment Station, USDA Forest Service: 147-156.

Ammon, V. and M.V. Patel. 2000. Annosum Root Rot. Ornamental and Tree Diseases. Plant Disease Dispatch Sheets. M-416. http://msucares.com/lawn/tree_diseases/416annosum.html.

Anderson, M.D. 2001. *Salix scouleriana*. *In* Fire Effects Information System, [Online]. Rocky Mountain Research Station, USDA Forest Service. Fire Sciences Laboratory. Available: http://www.fs.fed.us/database/feis/ [2005, April 6].

Angermeier P.L and J.R. Karr. 1984. Relationships between woody debris and fish habitat in a small warmwater stream. Transactions of the American Fisheries Society 113: 716-726.

Annesi, T., G. Curcio, L. D'Amico and E. Motta. 2005. Biological control of *Heterobasidion annosum* on *Pinus pinea* by *Phlebiopsis gigantea*. Forest Pathology. 35(2): 127-134.

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. N. American. Wildl. and Nat. Res. Conf. 47: 332-342.

Austin, K.K. 1993. Habitat use and home range size of breeding northern goshawks in the southern Cascades. M.S. Thesis, Oregon State Univ., Corvallis. 56pp.

Bailey, R.G. 1974. Land-capability classification of the Lake Tahoe basin, California-Nevada. Tahoe Regional Planning Agency, Zephyr Cove, Nevada, 31 p.

Baker, P.H., and A.J. Cordone. 1969. Distribution, size composition, and relative abundance of Piute sculpin *Cottus beldingi* Eigenmann and Eigenmann, in Lake Tahoe. Calif. Fish and Game 55: 285-297.

Banci, V. 1994. Wolverine. *In:* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen Tech Rpt RM-254. USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Barbour, R.W. and W.H. Davis. 1969. Bats of America. Univ. Press, Kentucky, Lexington, 286 p.

Barrows, C.W. 1981. Roost selection by spotted owls: an adaptation to heat stress. Condor 83: 302-309.

Barrows, C. and K. Barrows. 1978. Roost characteristics and behavioral thermoregulation in the spotted owl. West. Birds. 9: 1-8.

Beardsley, D.; C. Bolsinger, and R. Warbington. 1999. Old-growth Forests in the Sierra Nevada: by type in 1945 and by ownership in 1993. PNW-RP-516. Pacific Northwest Research Station, USDA Forest Service: 46 p.

Beier, P. and J.E. Drennan. 1997. Forest structure and prey abundance in foraging areas of northern goshawks. Ecological Applications. 7(2): 564-571.

Berg, N., A. Carlson, and D. Azuma. 1998. Function and dynamics of woody debris in stream reaches in the central Sierra Nevada, California. Canadian J. Fisheries and Aquatic Sciences. 55(8): 1807-1820.

Bent, A.C. 1961. Life histories of North American birds of prey, part 1. Dover Publications, Inc. New York, New York. 321-349.

Beschta, R.L. 1997. Riparian shade and stream temperature: An alternative perspective. Rangelands 19: 25-28

Bias, M.E. and R.J. Gutierrez. 1992. Habitat associations of California spotted owls in the central Sierra Nevada. J. Wildl. Manage. 56: 584-595.

Blakesley, J.A., B.R. Noon, and D.R. Anderson. 2005. Site occupancy, apparent survival, and reproduction of California spotted owls in relation to forest stand characteristics. J. Wildl. Manage. 69(4):1554-1564.

Blakesley, J.A., D.W.H. Shaw, and B.R. Noon. 2005b. Ecology of the California spotted owl on the Lassen National Forest, 1990-2004; Final Report. Colorado State Univ., Fort Collins. 30pp.

Bland, J.D. 1993. Forest grouse and mountain quail investigations: A final report for work completed during the summer of 1992. Unpubl. report, Wildl. Mgmt. Div., Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA.

Bland, J.D. 1997. Biogeography and conservation of blue grouse *Dendragapus obscurus*. California. Wildlife Biology 3(3/4):270.

Bland, J.D. 2002. Surveys of Mount Pinos Blue Grouse in Kern County, California, Spring 2002. Unpubl. report, Wildl. Mgmt. Div., Calif. Dept. Fish & Game, 1416 Ninth St., Sacramento, CA 95814.

Bland, J.D. 2006. Features of the Forest Canopy at Sierra Sooty Grouse Courtship Sites, Summer 2006. CDFG Contract No. S0680003.

Boal, C.W. and W. Mannan. 1994. Northern goshawk diets in ponderosa pine forests on the Kaibab Plateau. Studies in Avian Biology No. 16: 97-102.

Bombay, H.L. 1999. Scale perspectives in habitat selection and reproductive success for willow flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. Masters Thesis, California State Univ., Sacramento. 225 p.

Bombay, H.L., T.M. Benson, B.E. Valentine, and R.A. Stefani. 2003. A willow flycatcher survey protocol for California. June 6, 2000. USDA Forest Service, Pacific Southwest Region, Vallejo, CA. 50 p.

Bombay, H.L., M.L. Morrison, and L.S. Hall. 2003. Scale perspectives in habitat selection and animal performance for willow flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. Studies in Avian Biology. No. 26: 60-72.

Bombay, H.L., M.L. Morrison, D.E. Taylor, and J.W. Cain. 2001. Annual report and preliminary demographic analysis for willow flycatcher monitoring in the central Sierra Nevada. White Mountain Research Station, Univ. California, San Diego and USDA Forest Service, Tahoe National Forest. 46 p.

Bond, M.L., M.E. Seamans, and R.J. Gutierrez. 2004. Modeling nesting habitat selection of California spotted owls (*Strix occidentalis occidentalis*) in the central Sierra Nevada using standard forest inventory metrics. Forest Science 50: 773-780.

Breibart, A., J. Harris, and S. Norman. 2007. Forest Road BMP Upgrade Monitoring Report 2003-2005. USDA Forest Service, LTBMU.

Brown, C. 2008. Summary of Pacific Treefrog (*Pseudacris regilla*) Occupancy in the Sierra Nevada within the range of the Mountain Yellow-legged Frog (*Rana muscosa*). Sierra Nevada Amphibian Monitoring Program draft assessment, January 18, 2008.

Brown, J.K. and J.K. Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Rocky Mountain Research Station, USDA Forest Service: 257 p.

Bull, E.L., and M.G. Henjum. 1990. Ecology of the great gray owl. Gen. Tech. Rep. PNW-GTR-265. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station. 39pp.

Burnett, R.D., and D.L. Humple. 2003. Songbird monitoring in the Lassen National Forest: Results from the 2002 field season with summaries of 6 years of data (1997-2002). PRBO Conservation Science Contribution Number 1069. 36p.

Burnett, R.D., D.L. Humple, T.Gardali, and M.Rogner. 2005. Avian monitoring in Lassen National Forest 2004 Annual Report. PRBO Conservation Science Contribution Number 1242. 96p.

Buskirk, S.W., and R.A. Powell. 1994. Habitat ecology of fishers and American martens. Pages 283–296 *In:* S.W. Buskirk, A.S. Harestad, M.G. Raphael, and R.A. Powell, eds. Martens, sables and fishers: biology and conservation. Cornell Univ. Press, Ithaca, New York, USA.

Buskirk, S.W. and L.F. Ruggiero. 1994. American Marten. *In:* L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Buskirk, S.W. and W.J. Zielinski. 2003. Small and mid-sized carnivores. Pages 207-249 *In:* C.J. Zabel and R.G Anthony, eds. Mammal community dynamics: Management and conservation in coniferous forests of western North America. Cambridge Univ. Press, Cambridge, United Kingdom.

Cain III, J.W., M.L. Morrison, and H.L. Bombay. 2003. Predator activity and nest success of willow flycatchers and yellow warblers. Journal of Wildlife Management 67(3): 600-610.

California Department of Fish and Game (CDFG). 2004a. Resident Game Bird Hunting Final Environmental Document. August 5, 2004. State of California, The Resources Agency, Department of Fish and Game. 182 pp + appendices.

CDFG. 2004b. Report of the 2004 Game Take Hunter Survey. State of California, The Resources Agency, Department of Fish and Game. 20pp.

CDFG, California Interagency Task Group. 2005. California Wildlife Habitat Relationships (CWHR) version 8.1 personal computer program. Sacramento, CA.

CDFG. 2008. California Natural Diversity Database (CNDDB) personal computer program updated April 1, 2008. Sacramento, CA. From web at http://www.dfg.ca.gov/biogeodata/cnddb/rf_ftpinfo.asp

California Native Plant Society. 2008. Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

California Partners in Flight (CPIF). 2002. http://www.prbo.org/calpif/htmldocs/mapdocs/conifer/2002/fospmap2002.html. http://www.prbo.org/calpif/htmldocs/mapdocs/conifer/2002/bbwomap2002.html.

CPIF. 2004. http://www.prbo.org/calpif/htmldocs/mapdocs/riparian/2004/ywarmap2004.htm

CA Water Boards and Nevada Division of Environmental Protection. September 2007. Lake Tahoe TMDL Pollutant Reduction Opportunity Report.

Call, D.R., R.J. Gutierrez, and J. Verner. 1992. Foraging habitat and home-range charcteristics of California spotted owls in the Sierra Nevada. Condor 94: 880-888.

Call, M.W. 1978. Nesting habitats and survey techniques for common western raptors. USDI Bur. Of Land Manage., Sacramento. Tech. Rep. 24 p.

Chatfield, A.H. 2005. Habitat selection by a California spotted owl population: a landscape scale analysis using resource selection functions. Dept. Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, Minnesota. 59 p.

Choromanska, U. and T.H. DeLuca. 2001. Prescribed Fire Alters the Impact of Wildfire on Soil Biochemical Properties in a Ponderosa Pine Forest. Soil Sci. Soc. Am. J. 65: 232-238.

Christensen, W. and S. Norman. June 2007. 2006 Ward Unit 5 Soil Monitoring Report. Lake Tahoe Basin Management Unit, USDA Forest Service.

Citygate Associates. 2004. Fire Planning Process for the Urban-Wildland Interface in the City of South Lake Tahoe.

Copeland, J. 1996. Biology of the wolverine in Central Idaho. M.S. Thesis: University of Idaho, Moscow. 138pp.

Copeland, J. 1996. Biology of the wolverine in Central Idaho. M.S. Thesis: University of Idaho, Moscow. 138 p.

Cordone, A.J. and T.C. Frantz. 1968. An evaluation of trout planting in Lake Tahoe. California Department of Fish and Game 54: 68-69

County of El Dorado Department of Transportation (EDOT). August 2003. CEQA Initial Study for the Angora Creek SEZ Restoration Project.

Crocker-Bedford, D.C. 1990. Goshawk reproduction and forest management. Wildlife Society Bulletin 18: 262-269.

DeBano, L.F., D.G. Neary, and P.F. Folliott. 1998. Fire's Effects on Ecosystems. John Wiley and Sons, Inc. New York, NY.

Decker, L.M. 1989. Coexistence of two species of suckers, *Catastomus*, in Sagehen Creek, California and notes on their status in the western Lahontan basin. Great Basin Naturalist. 49: 540-551.

DeMars, C.J. and B.H. Roettgering. 1982. Forest Insect and Disease Leaflet 1:Western Pine Beetle (Berkley CA.). USDA Forest Service, PSW.

Detrich, P.J. 1986. The status and distribution of the bald eagle in California. M.S. Thesis. California Sate University, Chico.

Detrich, P.J. and B. Woodbridge. 1994. Territory fidelity, mate fidelity, and movements of color-marked northern goshawks in the southern Cascades of California. Studies in Avian Biology No. 16: 130-132.

Dost, F.N., L. Norris, and C. Glassman. 1996. (Unpubl.) Assessment of human health and environmental risks associated with the use of borax for cut stump treatment. prepared for USDA Forest Service Regions 5 and 6. 110.

Duncan, J.R. 1987. Movement strategies, mortality, and behavior of radio-marked great gray owls in southeastern Manitoba and northern Minnesota. *In:* R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre, eds.: Biology and conservation of northern forest owls: Symposium proceedings; 1987, February 3-7; Winnipeg, MB. Gen. Tech. Rep. RM-142. Fort Collins, CO. USDA, Forest Service, Rocky Mountain Forest and Range Exp. Station.

Eaglin, G.S. and W.A. Hubert. 1993. Effect of logging and roads on substrate and trout in streams of the Medicine Bow National Forest, Wyoming. North American J Fisheries Management 13: 844-846.

EDAW and PWA consultants. May 2005. Taylor, Tallac, and Spring Creek Watershed Ecosystem Assessment Report. Prepared for USDA Forest Service, LTBMU.

Erman, D.C. 1986. Long-term changes of fish populations in Sagehen creek, California. Trans. Am. Fish. Soc. 115: 682-692.

Fausch, K.D. and R.J. White. 1981. Competition between brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) for positions in a Michigan stream. Canadian J Fisheries and Aquatic Sciences 38: 1220–1227.

Fellers, G.M. and E.D. Pierson. 2002. Habitat use and foraging behavior of Townsend's big-eared bat (*Corynorhinus townsendii*) in coastal California. J Mammalogy, 83(1):167-177.

Ferrel, G.T. 1986. Forest Insect and Disease Leaflet 13: Fir Engraver. USDA Forest Service. Washington, D.C.:8 p.

Fettig, C.J., Kier D. Klepzig, R.F. Billings, A. S. Munson, T.E. Nebeker, J.F. Negron, J.T. Nowak. 2007. The Effectiveness of Vegetation Management Practices for Prevention and Control of Bark Beetle Infestations in Coniferous Forests of the Western and Southern United States. Forest Ecology and Management 238: 24-53

Forsman, E.D. 1980. Habitat utilization by spotted owls in the west-central Cascades of Oregon. Ph.D. Thesis. Oregon State Univ., Corvallis. 95 p.

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs No. 87. 1-64.

Fowler, C.S. and J.E. Bath. 1981. Pyramid Lake Northern Paiute Fishing: The Ethnographic Record. J California and Great Basin Anthropology.

Frantz, T.C. and A.J. Cordone. 1970. Food of Lake Trout in Lake Tahoe. California Fish and Game 56: 21-35.

Frazier J.W., K.B. Roby, J.A. Boberg, K. Kenfield, J.B. Reiner, D.L. Azuma, J.L. Furnish, B.P. Staab, S.L. Grant. 2005. Stream Condition Inventory Technical Guide. USDA Forest Service, Pacific Southwest Region - Ecosystem Conservation Staff. Vallejo, CA. 111 p.

Fretwell, S.D. and H.L. Lucas. 1970. On territorial behavior and other factors influencing habitat distribution in birds. Acta Biotheoretica 19: 16-36.

Froehlich, H.A., D.W.R. Miles, and R.W. Robbins. 1985. Soil bulk density recovery on compacted skid trails in central Idaho. Soil Sci. Soc. Am. J. 49: 1015–1017.

Froelich, R.C., C.S. Hodges, Jr., and S.S. Sackett. 1978. Prescribed burning reduces severity of annosus root rot in the South. Forest Science. 24(1): 93-100.

Furnish, J. 2005. Sensitive aquatic mollusks of the US Forest Service Pacific Southwest Region. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.

Gellman, S.T. and W.J. Zielinski. 1996. Use by bats of old-growth redwood hollows on the north coast of California. Journal of Mammalogy 77(1): 255-265.

Gerstung, E.R. 1988. Status, life history, and management of Lahontan cutthroat trout. American Fisheries Society Symposium 4: 93-106.

Gibilisco, C.J. 1994. Distributional dynamics of modern *Martes* in North America. *In:* S.W. Buskirk, A.S. Harestad, M.G. Raphael, and R.A. Powell, eds. Martens, Sables, and Fishers: Biology and Conservation. Cornell University Press, Ithaca, New York, USA. 59-71.

Godfrey, W.E. 1986. The birds of Canada (revised edition). National Museum of Natural Science, Ottowa, Canada.

Goldberg, M. August 2006. Lake Valley Fire Protection District Christmas Valley 3 Defense Zone Project, Operational and Monitoring Program.

Gomez, A., R.F. Powers, M.J. Singer, and W.R. Horvath. 2002. Soil compaction effects on growth of young ponderosa pine following litter removal in California's Sierra Nevada. Soil Sci. Soc. Am. J. 66: 1334–1343.

Graham, R.E. 1966. Observations on the roosting habits of the big-eared bat, *Plecotus townsendii*, in California limestone caves. Cave Notes. 8: 17-22.

Graham, R.T., R.T. Reynolds, M.H. Reiser, R.L. Bassett, and D.A. Boyce. 1994. Sustaining forest habitat for the northern goshawk: a question of scale. Studies in Avian Biology No. 16: 12-17.

Graham, R.T., A. Harvey, E. Alan, T.B. Jain, J.R. Tonn. 1999. The effects of thinning and similar stand treatments on fire behavior in western forests. Gen. Tech. Report. PNW-GTR-463. Pacific Northwest Research Station, USDA Forest Service.

Graham, R.T., R.L. Rodriguez, K.M. Paulin, R.L. Player, A.P. Heap, and R. Williams. 1999. The northern goshawk in Utah: habitat assessment and management recommendations. USDA Forest Service, Rocky Mountain Research Station, Gen Tech Rep RMRS-GTR-22.

Graham, R.W. and M.A. Graham. 1994. The Late Quaternary distribution of *Martes* in North America. *In*: S.W. Buskirk, A.S. Harestad, M.G. Raphael, and R.A. Powell, eds. Martens, Sables, and Fishers: Biology and Conservation. Cornell University Press, Ithaca, New York, USA. 26-58

Green, C. 1995. Habitat requirements of great gray owls in the central Sierra Nevada. M.S. Thesis. University of Michigan, MI. 94 p.

Green, G.A., H.L. Bombay, and M.L. Morrison. 2003. Conservation assessment of the willow flycatcher in the Sierra Nevada. Foster Wheeler Environmental Corporation and the University of California. 67 p.

Green, R.E. 2007. Distribution and habitat associations of forest carnivores and an evaluation of the California Wildlife Habitat Relationships model for American marten in Sequoia and Kings Canyon National Parks. Masters Thesis, Humboldt State Univ., Arcata, CA. 103 p.

Grinnell, J., J.S. Dixon, and J.M. Linsdale. 1937. Fur-bearing mammals of California: their natural history, systematic status and relations to man, volumes 1-2. Univ. California Press, Berkeley, California, USA. 777 p.

Grinnell, J. and A.H. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna No. 27. Cooper Ornitological Society, Berkeley, CA. 608 p.

Gutierrez R.J. and G.F. Barrowclough. 2005. Redefining the distributional boundaries of the northern and California spotted owls: implications for conservation. Condor. 107: 182-187.

Gutierrez R.J., A.B. Franklin, and W.S. LaHaye. 1995. Spotted owl (*Strix occidentalis*). The birds of North America, No 179. The American Ornithologists' Union, Washington D.C., USA, and the Academy of Natural Sciences, Philadelphia, Pennsylvania, USA.

Hall, E.R. 1981. The mammals of North America. 2d ed. New York: John Wiley & Sons. 1,181 p.

Han, S.K., H.S. Han, L.R. Johnson, and D.S. Page-Dumroese. (Unpubl). Impacts on soils from cut-to-length and whole tree harvesting.

Hargis, C.D., C. McCarthy, and R.D. Perloff. 1994. Home ranges and habitats of northern goshawk in eastern California. Studies in Avian Biology 16: 66-74.

Hawkins, C.P. 2003. Development, evaluation, and application of a RIVPACS-type predictive model for assessing the biological condition of streams in Region 5 (California) national forests. Completion Report. Western center for Monitoring and Assessment of Fresh Water Ecosystems. Utah State University. Logan, Utah 23 p.

Haskins, W. and D. Mayhood. 1997. Stream crossing density as a predictor of watershed impacts. ESRI User Conference Proceedings, San Diego, CA.

Hayward, G.D., and J. Verner, eds. 1994. Flammulated, boreal, and great gray owls in the United States: a technical conservation assessment. Gen. Tech. Rep. RM-253. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 214 p.

Heath, S.K., and G. Ballard. 2003. Bird species composition, phenology, nesting substrate, and productivity for the Owens Valley alluvial fan, Eastern Sierra Nevada, California 1998-2002. Great Basin Birds 6(1):18-35.

Hickman, J.C., Editor. 1993. The Jepson manual: higher plants of California. Univ. California Press, Berkeley, CA.

Hokanson, K.E.F., F. Kleiner, and T.W. Thorslund. 1977. Effects of constant temperatures and diel temperature fluctuations on specific growth and mortality rates and yield of juvenile rainbow trout, *Salmo gairdneri*. J. Fish Res. Board Can. 34: 639-648.

Hornocker, M.G. and H.S. Hash. 1981. Ecology of the wolverine in northwest Montana. Canadian J Zoology. 59: 1286-1301.

Huffman, E.L., L.H MacDonald, and J.D. Stednick. 2001. Strength and persistence of fire-induced soil hydrophobicity under ponderosa and lodgepole pine, Colorado Front Range. Hydrol. Process. 15:2877-2892.

Hughes, R.M. and D.P. Larsen. 1987. Ecoregions: an approach to surface water protection. Journal of the Water Pollution Control Federation 60:486-493.

Hutto, R.L. 1995. Composition of bird communities following stand-replacement fires in Northern Rocky Mountain (U.S.A.) conifer forests. Conservation Biology 9(5):1041-1058.

Hutto, R.L., and S.M. Gallo. 2006. The effects of postfire salvage logging on cavity-nesting birds. The Condor 108:817-831.

Implementation of the Conservation Strategy for Tahoe Yellow Cress (*Rorippa subumbellata*). 2006. Annual Report January 2007

Johnson, S.L. 2004. Factors influencing stream temperatures in small streams: substrate effects and a shading experiment. Can. J. Fish Aquat. Sci. 61: 913-923.

Jurek, R.M. 1988. Five-year status report, bald eagle. Calif. Dept. Fish and Game. Sacramento, California. 15 p.

Jones, I. R. and E. Allen. 2002. Detection of large woody debris accumulations in old-growth forests using sonic wave collection. Trans. Imp. Tree Sci. 120(2): 201-209.

Kamerath, M., S. Chandra and B.C. Allen. 2008. Distribution and impacts of warm water invasive fish in Lake Tahoe, USA. Aquatic Invasions. 3(1): 35-41.

Karr, J.R. and E.W. Chu. 1999. Restoring life in running waters - better biological monitoring. Island Press, Covelo, CA

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. Illinois Natural History Survey Special Publication 5, Champaign, IL.

Keane, J. J. 1999. Ecology of the northern goshawk in the Sierra Nevada, California. PhD. Dissertation. University of California, Davis, CA. 123 p.

Kegley, S.J; R.L. Livingston, and K.E. Gibson. 1997. Forest Insect and Disease Leaflet 122: Pine Engraver, *Ips pini* (Say), in the Western United States. Washington, D.C. USDA Forest Service: 8 p.

Kelsall, J.P. 1981. Status report on the wolverine, *Gulo gulo*, in Canada in 1981. Ottawa, On: Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 47 p.

Koronkiewicz, T.J., M.K. Sogge, C. Van Riper III, and E.H. Paxton. 2006. Territoriality, site fidelity, and survivorship of willow flycatchers wintering in Costa Rica. Condor 108: 558-570.

Kotliar, N.B., S.J. Hejl, R.L. Hutto, V.A. Saab, C.P. Melcher, and M.E. McFadzen. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the western United States. Studies in Avian Biology No.25:49-64.

Krohn, W.B., K.D. Elowe, and R.B. Boone. 1995. Relations among Fishers, Snow, and Martens: Development and Evaluation of Two Hypotheses. Forestry Chronicle 71: 97-105.

Krohn, W.B., W.J. Zielinski, and R.B. Boone. 1997. Relations among fishers, snow, and martens in California: results from small-scale spatial comparisons. *In*: G. Proulx, H.N. Bryant, and P.M. Woodard, eds. *Martes*: Taxonomy, Ecology, Techniques, and Management. Provincial Museum of Alberta, Edmonton, Canada. 211-32.

Kunz, T.H. and R.A. Martin. 1982. *Plecotus townsendii*. The American Society of Mammalogists, Mammalian Species, No. 175. 6 p.

Kundert, A. 1990. Interim Management Prescription for *Arabis rigidissima* var. *demota*. USDA Forest Service, Lake Tahoe Basin Management Unit. South Lake Tahoe.

Lake Tahoe Basin Management Unit (LTBMU). 2007. Lake Tahoe Basin Management Unit Multi Species Inventory and Monitoring (MSIM): A Foundation for Comprehensive Biological Status and Trend Monitoring in the Lake Tahoe Basin. Draft Report.

Lake Tahoe Basin Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy. 2007. (California Tahoe Conservancy, California State Parks, Nevada Division of Forestry, Nevada Division of state Lands, Nevada Division of State Parks, Nevada Fire Safe Council, USDA Forest Service, Tahoe Regional Planning Agency and the Tahoe Basin Fire Chiefs [Fallen Leaf Fire Department, Lake Valley Fire Protection District, Meeks Bay Fire Protection District, North Lake Tahoe Fire Protection District, North Tahoe Fire Protection District, South Lake Tahoe Fire Department, and Tahoe-Douglas Fire Protection District]).

Lake Tahoe Basin Weeds Coordinating Group. December 2007. Priority Invasive Weeds of the Lake Tahoe Basin.

Lanford, B.L. and B.J. Stokes. 1995. Compaction of two thinning systems: Part 1. Stand and site impacts. For. Pro. J. 45(5): 74-79.

Laverty, L. and J. Williams. 2000. Protecting people and sustaining resources in fire-adapted ecosystems-a cohesive strategy. GAO Report GAO/RCED-99-65. Appendix A. General Accounting Office:70-71.

Laves, K.S. and J.S. Romsos. 1998. Wintering bald eagle (*Haliaeetus leucocephalus*) and human recreational use on the south shore of Lake Tahoe. USDA Forest Service, Lake Tahoe Basin Management Unit, South Lake Tahoe, California. 31 p.

Laymon, S.A. 1987. Brown-headed cowbirds in California: historical perspectives and management opportunities in riparian habitats. Western Birds 18: 63-70.

Lehane, B.M., P.S. Giller, J.O Halloran, C. Smith, and J. Murphy. 2002. Experimental provision of large woody debris in streams as a trout management technique. Aquatic Conservation: Marine and Freshwater Ecosystems, 12(3): 289-311.

Lewis, J.C., R.T. Golightly, Jr., and R.M. Jurek. 1995. Introduction of nonnative foxes in California: Implications for the Sierra Nevada red fox. Transactions of the Western Section of The Wildlife Society 31: 29-32.

Lewis, J.C., K.L. Sallee, and R.T. Golightly Jr. 1993. Introduced red fox in California. Nongame Bird and Mammal Report 93-10. CA Department of Fish and Game, Sacramento, CA, USA.

Lewis, J.C., K.L. Sallee, and R.T. Golightly Jr. 1999. Introduction and range expansion of nonnative red foxes (Vulpes vulpes) in California. Am. Midl. Nat. 142: 372-381.

Liechty, H.O., M.G. Shelton, K.R. Luckow, and D.J. Turton. 2002. Impacts of shortleaf pine–hardwood forest management on soils in the Ouachita Highlands: a review. South. J. Appl. For. 26: 43-51.

Long, J.N. 1985. A Practical Approach to Density Management. Forestry Chronicle 61: 23-27.

Loupe, T.M., W.W. Miller, D.W. Johnson, E.M. Carroll, D. Hanseder, D. Glass, and R.F. Walker. March 2007. Inorganic Nitrogen and Phosphorus in Sierran Forest O Horizon Leachate. J Environmental Quality. 36: 498-507.

Loupe, T.M., W.W. Miller, D.W. Johnson, J.S. Sedinger, E.M. Carroll, R.F. Walker, J.D. Murphy, and C.M. Stein. (In press). Effects of Mechanical Harvest plus Chipping and Prescribed Fire on Sierran Runoff Water Quality. J Environmental Quality.

Lynch, J.A., G.B. Rishel and E.S. Corbett. 1984. Thermal alterations of streams draining clearcut watersheds: quantification and biological implications. Hydrobiologia. 111: 161-169.

Maholland, B. and T.F. Bullard. 2005. Sediment-related road effects on stream channel networks in an eastern Sierra Nevada watershed. J Nevada Water Resources Association 2: 57-70.

Mathewson, H.A., H.L. Loffland, M.L. Morrison, L. Vormwald, and C. Cocimano. 2007 annual report and preliminary demographic analysis for willow flycatcher monitoring in the central Sierra Nevada, in partial fulfillment of cost share agreement 06-CR-11052007 between Texas A&M University and USDA Forest Service, Region 5. Tahoe National Forest. December 31, 2007. 59 p.

Mayer, K.E., and W.F. Laudenslayer, eds. 1988. A Guide to Wildlife Habitats of California. California Department of Forestry and Fire Protection, Sacramento, CA. 166p.

Mayfield, H.F. 1977. Brown-headed cowbird: agent of extinction? American Birds 31: 107-113.

McCreedy, C. and S.K. Heath. 2004. Atypical willow flycatcher nesting sites in a recovering riparian corridor at Mono Lake, California. Western Birds. 35: 197-209.

McGrath, M.T., S. DeStefano, R.A. Riggs, L.L. Irwin, and G.J. Roloff. 2003. Spatially explicit influences on northern goshawk nesting habitat in the Pacific Interior Northwest. Wildlife Monographs, No. 154.

McNeil, T.F. and H.M. Ballard. 1992. Analysis of site stand impacts from thinning with a harvester-forwarder system. J. For. Eng. 4(1): 23-29.

Miller, G.S. 1989. Dispersal of juvenile northern spotted owls in western Oregon. M.S. Thesis, Oregon State Univ., Corvallis. 139 p.

Miller, R.G. 1951. The natural history of Lake Tahoe fishes [thesis]. Stanford Univ., Stanford, CA.

Miller, R.M., S.R. Colbert, and L.A. Morris. 2004. Effects of heavy equipment on physical properties of soils and on long-term productivity: a review of literature and current research. National Council for Air and Stream Improvement, Technical Bulletin No. 887, October, 2004, Research Triangle Park, NC.

Miller, W.W., D.W. Johnson, T.M. Loupe, J.S. Sedinger, E.M. Carroll, J.D. Murphy, R.F. Walker, and D. Glass. April-June 2006. Nutrients Flow from Runoff at Burned Forest Site in Lake Tahoe Basin. California Agriculture. 60(2): 65-71.

Miner, K.L. and D.C. Stokes. 2005. Bats in the south coast ecoregion: status, conservation issues, and research needs. *In:* USDA Forest Service, Gen. Tech. Rep. PSW-GTR-195. USDA Forest Service, Pacific Southwest Research Station, Albany, CA: 211-227.

Moyle, P.B. 2002. Inland fishes of California, revised and expanded. University of California Press, Berkeley, California, USA National Historic Preservation Act of 1966, As amended through 2000 [With annotations]. In Sections 308 and 309, pp. 1-47. vol. 16 U.S.C. 470.

Moyle, P.B. and R.A. Daniels. (1982). Fishes of the Pit River system, and Surprise Valley region. Univ. Calif. Publ. Zool. 115: 1-82.

Moyle, P. B., and P.J. Randall. 1996. Biotic integrity of watersheds. Pages 975-985 *In* Sierra Nevada Ecosystem Project: Final report to Congress , Vol. II, assessments, commissioned reports, and background information. Davis: University of California, Centers for Water and Wildland Resources.

Murphy, D.D. and C.M. Knopp, eds. 2000a. Lake Tahoe watershed assessment: Volume 1. Gen. Tech. Rep. PSW-GTR-175. USDA Forest Service, Pacific Southwest Research Station, Albany, CA. 736 p.

Murphy, D.D. and C.M. Knopp, eds. 2000b. Lake Tahoe watershed assessment: Volume 2. Gen. Tech. Rep. PSW-GTR-175. USDA Forest Service, Pacific Southwest Research Station, Albany, CA. 407 p.

Murphy, J.D., D.W. Johnson, W.W. Miller, R.F. Walker, E.F. Carroll, and R.R. Blank. 2006. Wildfire Effects on Soil Nutrients and Leaching in a Tahoe Basin Watershed. J. Environ. Qual. 35: 479-489.

Murphy, K., T. Rich, and T. Sexton. August 2007. An Assessment of Fuel Treatment Effects on Fire Behavior, Suppression Effectiveness, and Structure Ignition on the Angora Fire. USDA FS, R5-TP-025.

National Park Service. 1983. Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation: Professional Qualification Standards. Federal Register, Code of Federal Regulations, 36 CFR Part 61, Washington DC.

"Nature Serve Explorer." [Online] An online encyclopedia of life. Available at: http://www.natureserve.org/explorer/servlet/NatureServe?init=Species (Accessed 4/2008).

Neary, D.G., K.C. Ryan, and L.F. DeBano, eds. 2005. Wildland Fire in Ecosystems; Effects of Fire on Soil and Water. Gen. Tech. Rep. RMRS-GTR-42-vol. 4. USDA Forest Service, Rocky Mountain Research Station Ogden, UT. 250 p.

Nevada Natural Heritage Program. 2006. Nevada rare plant and lichen list. Carson City, NV.

Norman, S., T. Loupe, and J. Keely. January 2008. Heavenly Creek SEZ Demonstration Project Monitoring Report. Lake Tahoe Basin Management Unit, USDA Forest Service.

Omi, P.N. and E.J. Martinson. 2002. Effect of Fuels Treatment on Wildfire Severity. Western Forest Fire Research Center, Colorado State Univ.

Page-Dumroese, D.S., M.F. Jurgensen, A.E. Tiarks, F. Ponder, Jr., F.G. Sanchez, R.L. Fleming, J.M. Kranabetter, R.F. Powers, D.M. Stone, J.D. Elioff, and D.A. Scott. 2006. Soil physical property changes at the North American Long-Term Soil Productivity study sites: 1 and 5 years after compaction. Can. J. For. Res. 36: 551–564.

Perrine, J.D. 2005. Ecology of red fox (*Vulpes vulpes*) in the Lassen Peak region of California, USA. Dissertation, Univ. California, Berkeley. 251 p.

Peterson, A. 1986. Habitat suitability index models (breeding season). USDI Fish and Wildl. Serv. Biol. Rep. 82(10.126). 25 p.

Petersen, D.L., M.C. Johnson, J.K. Agee, K. James T.B. Jain, D. Mckenzie, and E.D. Reinhardt. 2003. Fuels Planning: managing Forest Structure to Reduce Fire Hazard. Pacific Northwest Research Station, USDA Forest Service. Seattle, WA.

Pierson, E.D. and W.E. Rainey. 1998. Distribution, status, and management of Townsend's big-eared bat (*Corynorhinus townsendii) In:* California. Wildlife Management Division Bird and Mammal Conservation Program Final Report for Contract No. FG7129. CA Dept. Fish and Game. 34 p.

Pollet, J. and P.N. Omi. 2000. Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. International Journal of Wildland Fire 11:1-10

Powell, R.A. 1993. The fisher: life history, ecology, and behavior. Univ. Minnesota Press, Minneapolis, USA.

Powell, R.A. and W.J. Zielinski. 1994. Fisher. Pages 38–73 *In:* L.F. Ruggerio, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. General Technical Report RM-254. USDA Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado, USA. 183 p.

Powers, R.F., D.A. Scott, F.G. Sanchez, R.A. Voldseth, D. Page-Dumroese, J.D. Elioff, and D. M. Stone. 2005. The North American long-term soil productivity experiment: Findings from the first decade of research. Forest Ecology and Management. 220: 31-50.

Quigley, T.M. 1981. Estimating Contribution of Overstory Vegetation to Stream Surface Shade. Wildlife Society Bulletin 9: 22-27.

Resh, V.H. and D.G. Price. 1984. Sequential sampling: a cost-effective approach for monitoring benthic macroinvertebrates in environmental impact assessments. Environmental Management 8:75-80.

Resh, V.H. and D.M. Rosenberg. 1989. Spatial-temporal variability and the study of aquatic insects. Canadian Entomologist 121:941-963.

Reuter J.E. and W.W. Miller. 2000. Aquatic resources, water quality and limnology of Lake Tahoe and its upland watershed Ch. 4: 150-166, *In:* Lake Tahoe Watershed Assessment. USDI.

Reynolds, R.T., R.T. Graham, M.H. Resier, and others. 1992. Management recommendations for the northern goshawk in the Southwestern United States. Gen. Tech. Rep. RM-217. Fort Collins, CO. USDA Forest Service Rocky Mountain Forest and Range Exp. Station.

Roest, A.I. 1977. Taxonomic status of the red fox in California. Final Report, Job II-1.3 CA Polytechnic State Univ., San Luis Obispo, CA, USA.

Rothermel, Ri.C. 1983. How to predict the spread and intensity of forest and range fires. Gen. Tech. Rep. GTR-INT-143.Intermountain Forest and Range Experiment Station, USDA Forest Service.

Sanders, S.D. and M.A. Flett. 1989. Montane riparian habitat and willow flycatchers: threats to a sensitive environment and species. Gen. Tech. Rep. PSW-110. USDA Forest Service, Pacific Southwest Research Station, Albany, California. 262-266.

Sands, R., E.L. Greacen, and C.J. Gerard. 1979. Compaction of sandy soils in radiata pine forests: I. A penetrometer study. Aust. J. Soil Res. 17: 101-113.

Saucedo, G.J. 2004. Geologic Map of the Lake Tahoe Basin, California and Nevada. CA Department of Conservation CA Geological Survey.

Sauer, J.R., J.E. Hines, and J. Fallon. 2007. The North American Breeding Bird Survey, Results and Analysis 1966 - 2006. Version 10.13.2007. USGS Patuxent Wildlife Research Center, Laurel, MD.

Sears, C.L. 2006. Assessing distribution, habitat suitability, and site occupancy of great gray owls (*Strix nebulosa*) in California. Thesis, Univ. California, Davis. 88 p.

Schempf, P.F. and M. White. 1977. Status of six furbearer populations in the mountains of northern California. USDA ForestService. 51 p.

Schmitt, C.L., J.R. Parmeter, and J.T. Kliejunas. 2000. Annosus Root Disease of Western Conifers. Forest Insect and Disease Leaflet 172. USDA Forest Service.

Scott, J. H.; Reinhardt, E. D. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. Research Paper. RMRS-RP-29. Rocky Mountain Research Station, USDA Forest Service. Ft. Collins, CO.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fish Res. Board Can. Bull. 184. 966 p.

Shepperd W.D., P. Rogers, D. Burton, and D.L. Bartos. 2006. Ecology, Biodiversity, Management, and Restoration of Aspen in the Sierra Nevada. Gen. Tech. Rep. GTR-178. Rocky Mountain Research Station, USDA Forest Service.

Siegel, R.B. and D.F. DeSante. 1999. Version 1.0. The draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. Institute for Bird Populations report to California Partners in Flight. Available on-line: http://www.prbo.org/calpif/htmldocs/sierra.html.

Siegel, R.B. and D.R. Kaschube. 2007. Landbird Monitoring Results from the Monitoring Avian Productivity and Survivorship (MAPS) Program in the Sierra Nevada. Final report in fulfillment of Forest Service Agreement No. 05-PA-11052007-141. The Institute for Bird Populations. February 13, 2007. 33p.

Siegel, R.B., Wilkerson, R.L., and D. DeSante. 2008. Extirpation of the willow flycatcher from Yosemite National Park. Western Birds 39: 8-21.

Sierra Nevada Research Center. 2007. Plumas Lassen Study 2006 Annual Report. USDA Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, Davis, California. 182pp.

Slauson, K.M. 2003. Habitat selection by American martes (*Martes americana*) in coastal northwestern California. Thesis, Oregon State Univ., Corvallis, Oregon, USA.

Smith, J.J. 1982. Fishes of the Parajo River system. Univ. Calif. Publ. Zool. 115: 83-170.

✓Smith, R.H. 1971. Forest Insect and Disease Leaflet 11: Jeffrey Pine Beetle. USDA Forest Service. Washington, D.C.:7 p.

✓Smucker, K.M., R.L. Hutto, and B.M. Steele. 2005. Changes in bird abundance after wildfire: importance of fire severity and time since fire. Ecological applications 15(5):1535-1549.

Solis, D.M. Jr. 1983. Summer habitat ecology of spotted owls in northwestern California. Thesis, Humboldt State Univ., Arcata, CA.

Squires, J.R. and R.T. Reynolds. 1997. Northern goshawk (*Accipiter gentilis*), the birds of North America online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/298

Stantec Consulting Inc. March 2006. Montgomery Estates Erosion Control and Cold Creek Fisheries Enhancement Projects Existing Conditions Report, Vol 1. Prepared for El Dorado County DOT.

State of California. Department of Food and Agriculture. Division of Plant Health & Pest Prevention Services. January 2004. Pest Ratings of Noxious Weed Species.

State of California Regional Water Quality Control Board, Lahontan Region. December 2005. Water Quality Control Plan for the Lahontan Region.

State of Nevada. Department of Agriculture, Plant Industry Division. 24. March 2005. Noxious Weed List.

Stefani, R.A., H.L. Bombay, and T.M. Benson. 2001. Willow flycatcher. *In:* USDA FS, Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, Volume 3, Chapter 3, Part 4.4. USDA, Forest Service, Pacific Southwest Region, Vallejo, CA. 143-195

Swanson Hydrology + Geomorphology. February 2006. Big Meadow Creek Watershed Ecosystem Assessment Report. Prepared for USDA Forest Service-, LTBMU.

Swanson Hydrology + Geomorphology. June 2007. Ecological Assessment Report for High Meadow Complex. Prepared for USDA Forest Service, LTBMU.

Swift L.W. and J.B. Messer. 1971. Forest cutting raise temperatures of small streams in the Southern Appalachians. J. Soil Water Conserv. 26:111-116

Tahoe Resource Conservation District. January 2003. Upper Truckee River Reclamation Project Environmental Assessment, Feasibility Report and Conceptual Plans. Prepared for the City of South Lake Tahoe and El Dorado County.

TRPA. 1982a. Regional Plan for the Lake Tahoe Basin: Threshold Carrying Capacities. Tahoe Regional Planning Agency, Zephyr Cove, NV.

TRPA. 1986). Regional Plan for the Lake Tahoe Basin: Goals and Policies. Tahoe Regional Planning Agency, Zephyr Cove, NV.

TRPA. 1987. Regional Plan for the Lake Tahoe Basin: Code of Ordinances, Rules of Procedures (Chapter 78 &79). Tahoe Regional Planning Agency, Zephyr Cove, NV.

TRPA. 1996. Regional Plan for the Lake Tahoe Basin: Threshold Evaluation. Tahoe Regional Planning Agency, Zephyr Cove, NV.

Tahoe Regional Planning Agency (TRPA). 1998. Regional Plan for the Lake Tahoe Basin: Code of Ordinances. Section IX. Resource Management Provisions, Chapter 75: Sensitive and Uncommon Plant Protection and Fire Hazard Reduction.

TRPA. 2000. (unpubl.). A GIS habitat model developed by Shane Romsos.

TRPA December 2004. Tahoe Regional Planning Agency Code of Ordinances.

TRPA 2002. Regional Plan for the Lake Tahoe Basin: Threshold Evaluation. Tahoe Regional Planning Agency, Zephyr Cove, NV.

TRPA. May 2006. Threshold Evaluation Report. Tahoe Regional Planning Agency.

TRPA. 2007. Fuel Reduction and Forest Restoration Plan for the Lake Tahoe Basin WUI. Tahoe Regional Planning Agency.

Tahoe Resource Conservation District. January 2003. Upper Truckee River Reclamation Project Environmental Assessment, Feasibility Report and Conceptual Plans. Prepared for the City of South Lake Tahoe and El Dorado County.

Tiarks, A.E., and J.D. Haywood. 1996. Effects of site preparation and fertilization on growth of slash pine over two rotations. Soil Sci. Soc. Am. J. 60: 1654-1663.

Timossi, I. 1990. California's statewide wildlife habitat relationships system. CA Dept. Fish and Game. Sacramento, CA. Computerized database.

Turner, M.G. 1989. Landscape ecology: the effect of pattern on process. Annual review of Ecology and Systematics. 20:171-197.

Ulery, A.L. and R.C. Graham. 1993. Forest fire effects on soil color and texture. Soil Sci. Soc. Am. 57:(11) 135-140.

USDA Forest Service. 1991 (revised 1993). Protocol for surveying for spotted owls in proposed management activity areas and habitat conservation areas, March 12, 1991 (revised February 1993). Pacific Southwest Region, Vallejo, CA.

USDA Forest Service. 1995. Borax, Pesticide Fact Sheet. November 1995. Prepared for USFS by Information Ventures, Inc. http://infoventures.com/e-hlth/pesticide/borax.html

USDA Forest Service. 1996. Biological Evaluation and Assessment and impact analysis check list. Updated January 1996 by John C. Robinson. Pacific Southwest Region. Vallejo, CA. 16 p.

USDA Forest Service. 2000. Assessment of BE's and BA's – Region 5 webpage reference at http://fsweb.r5.fs.fed.us/unit/ec/be_ba/BEBA_assessment.html by John C. Robinson. Pacific Southwest Region. Vallejo, CA. 8 p.

USDA Forest Service 2000. Water Quality Management for Forest System Lands in California: Best Management Practices. Pacific Southwest Region, September 2000.

USDA Forest Service. January 2001. Sierra Nevada Forest Plan Amendment (SNFPA) Final Environmental Impact Statement of Record of Decision. Pacific Southwest Region.

USDA Forest Service. June 2002. Investigating Water Quality in the Pacific Southwest Region Best Management Practices Evaluation Program (BMPEP User's Guide. Pacific Southwest Region, Vallejo, CA.

USDA Forest Service. January 2004. Regional Soil Quality Standards, Appendix F. Final Environmental Impact Statement, Sierra Nevada Forest Plan Amendment (SNFPA), v.4. Pacific Southwest Region, Vallejo, California.

USDA Forest Service. January 2004. Sierra Nevada Forest Plan Amendment (SNFPA) Final Supplemental Environmental Impact Statement; Record of Decision. Pacific Southwest Region; R5-MB-046.

USDA Forest Service. 2004. Sierra Nevada Forest Plan Amendment (SNFPA): Record of Decision and Final EIS. Pacific Southwest Region. Vallejo, CA.

USDA Forest Service. 2005. Conservation Guidelines for Seven Sensitive Fungi Species. Pacific Southwest Region.

USDA Forest Service. 2005. Sierra Nevada forest plan accomplishment monitoring report for 2004. USDA Forest Service, Pacific Southwest Region R5-MR-026. 8p.

USDA Forest Service. 2006. Sierra Nevada forest plan accomplishment monitoring report for 2005. USDA Forest Service, Pacific Southwest Region R5-MR-000. 12p.

USDA Forest Service. 2006. Forest Vegetation Simulator – Prognosis Model Version 6.21.

USDA Forest Service. 2006. Sensitive Species List 2006. Pacific Southwest Region. San Francisco, CA.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region. December, 2007. 18p.

USDA Forest Service. 2007b. Sierra Nevada forest plan accomplishment monitoring report for 2006. USDA Forest Service, Pacific Southwest Region R5-MR-149. 12p.

USDA Forest Service. 2007. Region 5 Draft Fen Assessment, "Mountain Studies Institute. Fen project" [Online] Available at: http://www.mountainstudies.org/Research/fenProject.htm 2006. David Cooper, et al.

USDA Forest Service. 2008. Sierra Nevada Forests Bioregional Management Indicator Species (MIS) Report: Life history and analysis of Management Indicator Species of the 10 Sierra Nevada National Forests: Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit. Pacific Southwest Region, Vallejo, CA. January 2008.

USDA Forest Service LTBMU. 1988. Land and Resource Management Plan for the Lake Tahoe Basin Management Unit.

USDA Forest Service, LTBMU. 2000. ATM and Roads Analysis Report. Lake Tahoe Basin Management Unit; unpublished.

USDA Forest Service, LTBMU. 2002. USDA Forest Service, Region 5, National Visitor Use Monitoring Results for Lake Tahoe Basin Management Unit

USDA Forest Service, LTBMU. 2004. South Shore Landscape Analysis

USDA Forest Service LTBMU. 2005. Updated sensitive species accounts. South Lake Tahoe, CA.

USDA Forest Service LTBMU. 2006. Region 5, National Visitor Use Monitoring Results for Lake Tahoe Basin Management Unit

USDA Forest Service LTBMU. 2006. LTBMU Habitat Models, LTBMU Botany Department, South Lake Tahoe, CA.

USDA Forest Service LTBMU. 2006. (unpubl). GIS habitat model developed by Victor Lyons.

USDA Forest Service LTBMU. 2006 and 2007. LTBMU Botanical field survey results, LTBMU Botany Department, South Lake Tahoe, CA.

USDA Forest Service LTBMU. 2008. Heavenly Creek SEZ Demonstration Project 2007 Soil Monitoring Report. Ecosystem Conservation Department.

USDA Forest Service LTBMU. (unpub) Stewardship and Fireshed Assessment, Ten-Year Integrated Vegetation and Fuels Management Program of Work 2007-2016, June 2007.

USDA Forest Service, Pacific Southwest Region, California State Historic Preservation Officer and Advisory Council on Historic Preservation. 2001. First Amended Regional Programmatic Agreement Among the U.S.D.A. Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding The Process for Compliance With Section 106 of The National Historic Preservation Act for Undertakings on The National Forests of The Pacific Southwest Region.

USDA Forest Service, Pacific Southwest Region; California State Historic Preservation Officer and Advisory Council on Historic Preservation. 2004. Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects: (Sierra PA).

USDA Forest Service Washington Office. Four Threats to the Health of the Nation's Forests and Grasslands.

U.S. Geological Survey. K.D. Cartier, L.A. Peltz, and J.L. Smith. 1994. Water-Resources Investigations Report 93-4182. Development and Documentation of Spatial Data Bases for the Lake Tahoe Basin, California and Nevada.

USDA Natural Resources Conservation Service (NRCS). 1998. National Forestry Manual, September 1998. http://soils.usda.gov/technical/nfmanual/.

USDA NRCS. 2007. Soil survey of the Tahoe Basin Area, California and Nevada. Accessible online at: http://soils.usda.gov/survey/printed_surveys/.

USDI Fish and Wildlife Service (FWS). 1995. Lahontan cutthroat trout (*Oncorhuynchus clarkihenshawi*) recovery plan. Portland, OR.

USDI FWS. 2006. Endangered and Threatened Wildlife and Plants; 12-month Finding for a Petition to List the California Spotted Owl (*Strix occidentalis occidentalis*) as Threatened or Endangered. Department of the Interior, Fish and Wildlife Service, 50 CFR Part 17. Federal Register: May 24, 2006, Volume 71, Number 100, pages 29886-29908.

USDI Fish and Wildlife Service. 2007. Sacramento, CA Home Page. http://www.fws.gov/sacramento/es/spp_lists/NFActionPage.cfm

USDI and U.S. Geological Survey. A.J. Ranalli. 2004. A Summary of the Scientific Literature on the Effects of Fire on the Concentrations of Nutrients in Surface Waters. Open-file Report 2004-1296.

Unitt, P. 1999. A multivariate approach to identification of the willow flycatcher and its subspecies. Unpublished report. Bureau of Reclamation, Phoenix, Arizona. *In* U.S. Department of Agriculture (2001) Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement. Chapter 3, Part 4. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.

Vander Zanden, J., S. Chandra, B.C. Allen, J.E. Reuter, and C.R. Goldman. 2003. Historical Food Web Structure and Restoration of Native Aquatic Communities in the Lake Tahoe (California-Nevada) Basin. Ecosystems 6: 274-288.

Verner, J.and K.S. McKelvey. 1994. Developing and Managing Sustainable Forest Ecosystems for Spotted Owls in the Sierra Nevada. *In:* L. Foley, ed. Silviculture: From the Cradle of Forestry to Ecosystem Management, Proceedings of the National Silviculture Workshop; November 1-4, 1993 Gen. Tech Rep. GTR.-SE-88. Southeastern Forest Experiment Station, USDA Forest Service: 82-98.

Verner, J., K.S. McKelvey, B.R. Noon, R.J. Gutierrez, I.G. Gould, Jr., and T.W. Beck, Tech. Coords. 1992. The California spotted owl: a technical assessment of its current status. Gen. Tech. Rep. PSW-GTR-133. Albany, CA: Pacific Southwest Research Station, USDA FS. 285 p.

Watershed Restoration Associates (WRA). December 2000. Trout Creek Stream Restoration and Wildlife Enhancement Project Phase 3 Design Report. Prepared for City of South Lake Tahoe.

Weathers, W.W., P.J. Hodum, and J.A. Blakesley. 2001. Thermal ecology and ecological energetics of California spotted owls. Condor. 103:678-690.

Weaver, R., T. Biddinger, and B. Rust. July 2007. Hydrology and Soil Resource Assessment; Angora Fire Burn Area Assessment. USDA Forest Service, Lake Tahoe Basin Management Unit.

Whitfield, M.J. and M.K. Sogge. 1999. Rangewide impact of brown-headed cowbird parasitism on the southwestern willow flycatcher (*Empidonax traillii extimus*). *In:* M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich, eds. Research and management of the brown-headed cowbird in western landscapes. Studies in Avian Biology No. 18. Cooper Ornithological Society, Camarillo, CA. 182-190.

Wilbur-E. (undated). Sporax, a borax fungicide for control of annosus root disease. Label published by Wilbur-Ellis Co., Fresno California. Accessed on-line at http://www.cdms.net/ldat/ld1NU004.pdf on September 1, 2005.

Williamson, J.R. and W.A. Neilsen. 2000. The influence of forest site on rate and extent of soil compaction and profile disturbance of skid trails during ground-based harvesting. Can. J. For. Res. 30: 1196-1205.

Wilson, D.E. 1982. Wolverine. *In:* J.A. Chapman and G.A. Feldhamer, eds. Wild mammals of North America. Biology, management and economics. Baltimore, MD: Johns Hopkins University Press: 644-652. Chapter 32.

Woodbridge, B. and C.D. Hargis. 2006. Northern goshawk inventory and monitoring technical guide. Gen. Tech. Rep. WO-71. Washington, DC: USDA FS. 80 p.

Young, R.J. and M.L. Morrison. 2007. Assessment of goshawk territories within the Lake Tahoe basin; March 2004 – September 2005. Unpubl. report. 61 p.

Zeiner, D.C., W.F. Laudenslayer, K.E.Mayer, and M. White, eds. 1990. California's wildlife: birds. California Department of Fish and Game, Sacramento, California, USA.

Zielinski W.J., and T.E. Kucera, (Eds). 1995. American Marten, Fisher, Lynx, and Wolverine: Survey Methods for their Detection. USDA Forest Service, Pacific Southwest Research Station, Gen Tech Rep PSW-GTR-157.

Zielinski, W.J., T.E. Kucera, and R.H. Barrett. 1995. The current distribution of the fisher, *Martes pennanti*, in California. California Fish and Game 81: 104-112.

Zielinski, W.J., R.L. Truex, F.V. Schlexer, L.A. Campbell, and C. Carroll. 2005. Historical and contemporary distributions of carnivores in forests of the Sierra Nevada, California, USA. Journal of Biogeography 32:1385-1407.

Zeilinski, W.J., J. Werren, T. Kirk, and K. Slauson. 2006. Interactions between fishers and martens in California and implications for their conservation. Oral presentation in Fisher and marten in California, moving science & management forward; symposium presented by the California North Coast Chapter of the Wildlife Society and the Western Section of the Wildlife Society, Sacramento, CA. February 7-8, 2006.

Zimmerman, G.S., W.S. LaHaye, and R.J. Gutierrez. 2003. Empirical support for a despotic distribution in a California spotted owl population. Behavioral Ecology. 14: 433-437.

Forest Service Handbooks and Manuals

FSH 462. National Forest Landscape Management Volume 2, Chapter 1. The Visual Management System. USDA Forest Service. 1974.

FSH 701. Landscape Aesthetics A Handbook For Scenery Management. USDA Forest Service. 1995.

FSH 701. Landscape Aesthetics A Handbook for Scenery Management – Appendix J. USDA Forest Service. 8/30/07

FSH 2409.15-92-6. Timber Sale Administration Handbook WO Amendment. USDA Forest Service. Effective 8/3/92.

FSH 2509.18-95-1. Soil Management Handbook WO Amendment. USDA Forest Service. Effective 9/3/91.

FSH 2509.18-95-1. Soil Mangement Handbook R5 Supplement. USDA Forest Service. June 11, 1995.

FSH 2509.22, Ch. 50. R5 Soil and Water Conservation Handbook. California Interagency Erosion Hazard Rating. USDA Forest Service and California Soil Survey Committee. 1990.

FSH 2520. Chapter 20, Amendment 1. Soil and Water Conservation Handbook, Cumulative Off-site Watershed Effects Analysis. USDA Forest Service, Pacific Southwest Region, Vallejo, California. 1988.

FSM 2080. Noxious Weed Management. USDA Forest Service. 29 November 1995.

FSM 2609.25. USDA Forest Service, Pacific Southwest Region. 2006.

Appendix A

Past, Present, and Future Restoration Projects within the South Shore Project Area

On the following pages is a table listing the restoration projects or activities as well as a brief description of the project and expected effects. See Map 6 for the location of the projects.

Project or Activity Name	Brief Project Scope or Description	General Location	HUC 7 Watershed	Project Scale (acres, miles, or feet)	Positive or Negative Ongoing Effect	Year of Project Implementation	Expected Year that Effects Become Neutral	Resources Potentially Affected by the Activity 1
Cold Creek, below Pioneer Trail	Stream Restoration	Cold Creek	Cold Creek	6,000 ft.	Positive, restored stream	1994-1995	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Glen Alpine Trailhead Parking	Paving and BMP of parking area	Fallen Leaf Lake	Glen Alpine Creek	2-3 acres	Positive, reduces erosion	1996	1998 – short-term negative, 2018 – long-term positive	S, Veg, W, Sc
Glen Alpine Low Water Crossing	Armor low water crossing	Fallen Leaf Lake	Glen Alpine Creek	.5 mile	Positive, reduces erosion	1996`	1997 – short-term negative, 2012 – long-term positive	S, W, Veg, Sc
Oneidas Road	Chip seal and BMP unpaved road	Saxon Creek	Headwaters of Trout Creek	4 miles	Positive, reduces erosion	1997	1998 – short-term negative, 2013 – long-term positive	S, W, Veg, Sc, F

Cathedral Road and Trail	BMP road and reroute trails out of SEZ	Taylor Creek	Taylor Creek	1 mile	Positive, reduces erosion	1997	1999 – short-term negative, 2019 – long-term positive	S, W, Veg, Sc
Gardner Mountain Road and Trail	BMP road and reroute trails out of SEZ	Upper Truckee River	Camp Richardson Frontal	2 miles	Positive, reduces erosion	1998	2000 – short-term negative, 2020 – long-term positive	S, W, Veg, Sc
Luther Pass Trailhead Toilet	Construct toilet building	Luther Pass	Big Meadow Creek	0.25 acre	Positive, public health & sanitation	1998	1999 – short-term negative, Permanent long-term positive	S, W, Rec, Sc
Stream Profile Chamber	Reconstruct Stream Profile chamber	Taylor Creek	Taylor Creek	0.25 acre	Positive, enhanced interpretaion	1998	1998 – short-term negative, Permanent long-term positive	S, W, Rec, Sc
Angora Creek Restoration	Golf Course & Sewer reaches	Angora Creek	Angora Creek	8,000 ft.	Positive, restored channel	Golf course 1997-98 Sewer reach 2002	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Trout Creek, below Pioneer trail	Channel Restoration & Riparian enhancement	Trout Creek	Lower Trout Creek	10,075 ft 25 acres	Positive, restored channel; Improved habitat	1999-2001	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Lower West Side	Fill removal project	Lower Truckee River & Trout Creek	Lower Upper Truckee River & Lower Trout Creek	12 acres	Positive, restored floodplain, meadow terrace	2001	Permanent	WL, S, Veg, F, W, Rec, Sc, A

Pioneer/Powerline Road Access and Travel Management (ATM)	Road decomissioning, road upgrade and BMP, road to trail conversion	Powerline corridor		7 miles BMP road 3.5 miles decommis sion	Positive, reduces erosion	2001	2002 – short-term negative, 2022 – long-term positive	S, W, Veg, WL, Rec, Sc
Rainbow Trail	Construct paved trail and boardwalk through Taylor Creek Marsh	Taylor Creek	Talyor Creek	1 mile	Positive, reduces trampling of vegetation, including sensitive plant species	2001	2001 – short-term negative, Permanent long-term positive	Veg, Rec, Sc, S, W.
LTBMU Supervisor's Office	Construct SO office building	Al Tahoe Blvd.	Lower Trout Creek	3 acres	Negative, increases impermeable surfaces	2002-2003	2004 – short-term negative, Permanent long-term negative	S, W, Veg, WL,
Angora Lakes Resort Parking and Toilet	Paving and BMP of parking area, install toilet	Fallen Leaf Lake	Angora Creek	2 acres	Positive, reduces erosion	2002-2005	2006 – short-term negative, 2026 -long-term positive	
Culvert Replacement	Upgrade drainage structures to improve water transport	Upper Trout Creek	Headwaters of Trout Creek	0.5 acre	Positive, reduces erosion, improves hydrology	2003	2004 – short-term negative, 2019 – long-term positive	
Kiva Picnic Area Toilets	Construct toilet buildings, accessible routes to buildings, BMPs	Taylor Creek	Camp Richardson Frontal	0.1 acre	Positive, improves public sanitation	2003	2004 – short-term negative, Permanent long-term positive	
Fallen Leaf Campground Toilets	Replace toilet buildings, construct accessible routes to buildings, BMPs	Fallen Leaf Lake	Taylor Creek	1 acre	Positive, improves public access & sanitation	2003	2004 – short-term negative, Permanent long-term positive	
Angora Ridge Road	Pave and BMP road	Fallen Leaf Lake	Taylor Creek & Angora Creek	3 miles	Positive, reduces erosion	2003	2004 – short-term negative, 2024 – long-term positive	

Fountain Place Road Parking area BMPs	BMP existing day use parking area	Saxon & Trout Creeks	Headwaters of Trout Creek	2 acres	Positive, reduces erosion	2003	2004 – short-term negative, 2019 – long-term positive	
Lake of the Sky Amphitheatre	Replacement of Amphitheatre, install BMPs, reduce capacity	Taylor Creek Visitors Center	Taylor Creek	0.5 acre	Positive, enhances recreation, reduces impermeable surface	2003	2004 – short-term negative, Permanent long-term positive	
Cold Creek Trail bridge and trail BMPs	Upgrade bridge to improve hydologic function, reroute trails out of SEZs, add BMPs	Cold Creek	Cold Creek	3 acres	Positive, reduces erosion, improves water transport	2003	2004 – short-term negative, 2034 – long-term positive	S, W, Veg, Rec
Bridge Replacement	Upgrade bridge to improve hydrologic function	Saxon Creek	Saxon Creek	1 acre	Positive, reduces erosion, improves water transport	2003-2004	2005 – short-term negative, 2035 – long-term positive	S, W, Veg, Rec
Bridge Replacement	Upgrade bridge to improve hydrologic function	Trout Creek	Headwaters of Trout Creek	1 acre	Positive, reduces erosion, improves water transport	2003-2004	2005 – short-term negative, 2035 – long-term positive	S, W, Veg, Rec
Bridge Replacement	Upgrade bridge to improve hydrologic function	Columbine Creek	Saxon Creek	1 acre	Positive, reduces erosion, improves water transport	2003-2004	2005 – short-term negative, 2035 – long-term positive	S, W, Veg, Rec
Big Meadow Trail	Reconstruct and BMP trail	Luther Pass	Big Meadow Creek	1 mile	Positive, reduces erosion	2004	2005 – short-term negative, 2025 – long-term positive	
Armstrong Bridge	Replace and upgrade bridge to improve public safety and hydrologic function	Fountain Place	Headwaters of Trout Creek	1 acre	Positive, improves public sarety, reduces erotion	2004	2005 – short-term negative, 2035 – long-term positive	S, W, Rec,

Freel Peak Trail	Construct trail to control user-created trails	Freel Peak	Cold Creek	1 mile new trail, 1 mile closure	Positive, reduces erosion	2004	2004 – short-term negative, 2019 – long-term positive	
Fallen Leaf Water System	Upgrade and replace utility infrastructure, including BMP of tank access road	Fallen Leaf Road	Taylor Creek	0.5 mile BMP	Positive, reduces erosion potential	2004-2008	2009 – short-term negative, Permanent long-term positive	
Emerald Bay/Camp Richardson road ATM	Road decomissioning, road upgrade & BMP, Road to trail conversion	Emerald Bay, Camp Richardson	Camp Richardson Frontal	No net change	Positive, reduces erosion	2005	2007 – short-term negative, 2027 – long-term positive	
Pope Estate Wall	Repair historic wall	Taylor Creek	Camp Richardson Frontal	0.1 acre		2005	2005 – short-term negative,	
South Tahoe Public Utility Dept. B line	Instal sewer export line, upgrade overflow campground, replace and upgrade bridge	Luther Pass	Middle Upper Truckee R, Grass Lake, Big Meadow Creek	1 acre, 1 mile	Positive, water quality improvement, reduces erosion	2005	2007 – short-term negative, Permanent long-term positive	
Angora Creek Restoration	Restoration above View Circle & low water crossing	Angora Creek	Angora Creek	2,300 ft. & 4.5 acres	Positive, restored channel & SEZ enhancement	2005-2006	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Pope Beach BMP upgrade	Implementation of BMPs & drainage structures in Parking area. Removal of impermable coverage from Pope Beach	Pope Beach	Camp Richardson Frontal	2 acres	Positive, reduces erosion, reduces hydrocarbons	2005-2006	2007 – short-term negative, 2027 – long-term positive	S, W, Veg, Rec
Cookhouse Meadow Restoration	Channel restoration	Upper Truckee River	Middle Upper Truckee River	2,200 ft.	Positive, restored channel	2005	Permanent	WL, S, Veg, F, W, Rec, Sc, A

Baldwin Beach Toilet	Replaced 1 toilet building	Baldwin Beach	Tallac Creek	0.1 acre	Positive, public sanitation	2006	2007 – short-term negative, Permanent long-term positive	
Luther Pass Campground Toilet	Install vault toilet & BMPs	Luther Pass	Big Meadow Creek	0.25 acre	Positive, public sanitation	2006	2007 – short-term negative, Permanent long-term positive	
Ebright Beach Toilet	Install vault toilet on beach	Baldwin Beach	Tallac Creek	0.1 acre	Positive, public sanitation	2006	2006 – short-term negative, Permanent long-term positive	
Corral Trail, Sidewinder Trail, Cedar Trail, Corral/Armstrong connector, Reroute of Armstrong Trail	Reconstruct & BMP trails, construct and decommission trails	Trout Creek	Headwaters of Trout Creek	25 miles BMP, 4 miles new, 8 miles decommis sion	Positive, reduces erosion	2006	2007 – short-term negative, 2022 – long-term positive	
Richardson House Parking	Pave & BMP existing parking at Richardson House	Camp Richardson	Camp Richardson Frontal	1 acre	Positive, reduces erosion & hydrocarbons	2006	2007 – short-term negative, 2022 – long-term positive	
Fallen Leaf Lake Log Boom	Install log boom to prevent blockages of Fallen Leaf Dam	Fallen Leaf Lake	Taylor Creek	2 acres	Neutral	2007	2007 –short-2017 – long-term neutral	
Baldwin Beach Tree and Kiosk	Remove pavement from parking lot tree, install pavement to accommodate new entry kiosk	Tallac Creek	Tallac Creek	No net change	Neutral	2007	Neutral, relocation of coverage	Rec
Pope Beach Toilets	Replace 2 toilet buildings	Pope Beach	Camp Richardson Frontal	0.2 acres	Positive, improves recreation facilities	2007-2008	2008 – short-term negative, Permanent long-term positive	

Spring Creek bridge replacement	Replaced bridge, removed fish passage and water conveyance barriers	Spring Creek	Tallac Creek	N/A	Positive, restores fish passage	2008	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Hawley Grade Trail Stabilization	Construct retaining wall to stabilize landslide	Christmas Valley	Middle Upper Truckee River	2 acres, 0.25 mile	Positive, reduces erosion	2008	2009 – short-term negative, 2029 – long-term positive	
Recreation Residence BMPs	Implement BMPs at all recreation residences	Echo Lakes, Tallac Creek Christmas Valley	Echo Creek Tallac Creek Middle Upper Truckee R.	1,000 acres	Positive, reduces erosion	2008	2009 – short-term negative, 2025 – long-term positive	
Tallac Creek Bridge and Channel Reconstruction	Replace & upgrage bridge, culverts, etc. Reconstruct stream channel to improve hydrologic function	Tallac Creek	Tallac Creek	1 acre	Positive, reduces erosion	2008	2009 – short-term negative, 2039 – long-term positive	
Upper Truckee Guard Station BMPs	BMP upgrade of facilities	Upper Truckee	Middle Upper Truckee R.	1 acre	Positive, reduces erosion	2008	2009 – short-term negative, 2029 – long-term positive	
Valhalla Pier Upgrade	Construct accessibility upgrades with BMPs	Taylor Creek, Pope Marsh	Camp Richardson Frontal	0.1 acre	Positive, reduces erosion	2008	2009 – short-term negative, 2024 – long-term positive	
Angora/Twin Peaks Road BMPs	Decommission road, road upgrade & BMP	Angora, Fallen Leaf	Angora Creek	1 mile	Positive, reduces erosion	2008	2010 – short-term negative, 2030 – long-term positive	
Angora Fire Suppression Rehab, BAER Roads & Trails	Obliterate fire suppression routes & repair/maintain drainage improvements	Angora, Fallen Leaf	Angora Creek, Camp Richardson Frontal	3 miles	Positive, reduces erosion	2008	2010 – short-term negative, 2030 – long-term positive	

Upper Truckee River	Stream channel restoration	Airport Reach	Lower Upper Truckee	4,000 ft/	Positive, restore channel	Planned 2008-2010	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Kiva Picnic Area BMPs	Parking Area BMPs	Taylor Creek	Camp Richardson Frontal	3 acres	Positive, reduces erosion & hydrocarbons	2008	2010 – short-term negative, 2030 – long-term positive	
Meyers Landfill	Construct impermeable cap and BMPs for polluted landfill	Trout Creek	Saxon Creek	10 acres	Positive, reduces groungwater pollution	Planned 2009	2011 – short-term negative, 2041 – long-term positive	
Saxon Creek Low Water Crossing	Upgrade stream crossing to reduce erosion and improve hydrologic function	Saxon Creek	Headwaters Trout Creek	0.5 acre	Positive, reduces erosion	Planned 2009	2010 – short-term negative, 2025 – long-term positive	
Fredrick's Cabin Rehabilitation	Upgrade building and BMP site	Fallen Leaf Lake	Taylor Creek	1 acre	Positive, reduces erosion & hydrocarbons	Planned 2009	2011 – short-term negative, 2026 – long-term positive	
Fallen Leaf Campground BMPs	BMP upgrade of campground facilities	Taylor Creek, Fallen Leaf	Taylor Creek	10 acres	Positive, reduces erosion	Planned 2009	2011 – short-term negative, 2041 – long-term positive	
Old Mill Cabin BMP	BMP upgrade of facilities	Fallen Leaf	Taylor Creek	0.25 acre	Positive, reduces erosion	Planned 2009	2010 – short-term negative, 2025 – long-term positive	
High Meadows Road and Trail ATM Implementation	Decommission and re-route of roads & trails to reduce erosion potential	Cold Creek	Cold Creek	6 miles BMP, 12 miles decommis sion, 7 miles new	Positive, reduces erosion	Planned 2009	2011 – short-term negative, 2031 – long-term positive	S. W, Veg, F, WL, Rec, Sc

Upper Truckee River	Stream channel restoration	Sunset Reach	Lower Upper Truckee	12,000 ft.	Positive, restore channel	Planned 2009-2011	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Cold Creek, High Meadows	Stream channel restoration	Cold Creek in High Meadows area	Cold Creek	18,000 ft.	Positive, restore channel	Planned 2009-2011	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Lake Tahoe Greenway Trail	Construct paved trail from Meyers to Stateline	Various	Cold Creek, Heavenly Valley Creek, Lower Trout Creek, Bijopu Frontage, Lower Upper Truckee R.	6 miles new trail	Neutral, new development with full BMPs	Planned 2009-2011	2012 – short-term negative, Permanent long-term neutral	Rec
Camp Richardson Campground	Reduce coverage and BMP campground	Camp Richardson	Camp Richardson Frontal	80 acres	Positive, reduces erosion	Planned 2010-2012	2014 – short-term negative, 2039 – long-term positive	
Cabin Area Replacement	Replace Cabin buildings, road, parking & BMPs	Camp Richardson	Camp Richardson Frontal	20 acres	Positive, reduces erosion	Planned 2009-2013	2014 – short-term negative, 2044 – long-term positive	S, W, Veg, Rec
Taylor Creek Environmental Education Center	Replace existing Visitor center & utilities, BMP building	Taylor Creek	Taylor Creek	1 acre	Neutral, new development with full BMPs	Planned 2010	2010 – short-term negative, Permanent long-term neutral	Rec
Echo Lakes Trailhead Parking area	Paving and BMP of Parking area	Echo Lakes	Echo Creek	3 acres	Positive, reduces erosion	Planned 2010	2011 – short-term negative, 2031 – long-term positive	S, W, Rec,

Camp Richardson Day Use Parking	BMP existing day use parking area	Pope Marsh	Camp Ridhardson Frontal	1 acre	Positive, reduces erosion	Planned 2010	2011 – short-term negative, 2031 – long-term positive	S, W, Rec,
Meyers Work Center BMPs	BMP existing parking area and buildings	Meyers	Osgood Swamp	5 acres	Positive, reduces erosion	Planned 2010	2011 – short-term negative, 2031 – long-term positive	
Baldwin Beach BMPs	BMP existing parking and roads to improve hydrologic function	Tallac Creek	Tallac Creek	5 acres	Positive, reduces erosion & hydrocarbons	Planned 2010	2011 – short-term negative, 2041 – long-term positive	
Fallen Leaf Trails ATM implementation	Decommission, upgrade, reconstruct trails to meet BMP standards	Fallen Leaf Lake, Camp Richardson	Tallac Creek Taylor Creek, Camp Richardson Frontal, Angora Creek					
Upper Truckee River	Stream channel restoration	Marsh Reach	Lower Upper Truckee	9,000 ft.	Positive, restore channel	Planned 2011-2012	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Upper Truckee River	Stream channel restoration	Golf Course Reach	Osgood Swamp	7,920 ft.	Positive, restore channel	Planned 2012-2014	Permanent	WL, S, Veg, F, W, Rec, Sc, A
Upper Truckee River	Stream channel restoration, Design 60% complete, no projection for project timing	Reach 1	Lower Upper Truckee	4,226 ft.	Positive, restore channel	??	Permanent	WL, S, Veg, F, W, Rec, Sc, A

Appendix B

Limited Operating Periods for Special Status Species in the Project Area

Focal Wildlife Species

Wildlife objectives and design features for this project are centered on land allocations to address regional and forest management direction; disturbance zones to address TRPA wildlife resource management provisions; and ecosystem types to address the interconnectedness of natural resources within the primary objective of the project (hazardous fuels reduction). The project would affect vegetative characteristics of focal wildlife species habitats on the forest. Special status, or focal, wildlife species for the South Shore Project area include those listed as threatened (T), endangered (E), candidate (C), or de-listed (D) by the U.S. Fish & Wildlife Service (FWS); Forest Service sensitive (S) species, management indicator species (MIS) in the LTBMU Forest Plan (USFS); and special interest species (SIS) by the Tahoe Regional Planning Agency (TRPA).

All focal wildlife species will be included with the biological evaluation and biological analysis (BE/BA) for this project. Limited operating periods (LOPs) would apply, following the recommendations of the forest biologist, consistent with SNFPA and LRMP direction for wildlife species as presented below. The TRPA Code of Ordinances direction for wildlife species LOPs would also apply.

The implementation of LOPs for marten and/or fisher dens, great gray owl PACs, and Yosemite toad sites are unlikely as they have not been discovered, delineated, or are not known to occur within the Lake Tahoe basin.

Limited Operating Periods

Reason For Restrictions	Limited Operating Period (LOP) And Impacted Activity	Adjustments Allowed
California Spotted Owl PAC	**March 1 through August 15** (SNFPA 2004) - no timber thinning, prescribed fire, restoration projects, or road or trail building within 1/4 mile of activity center.	SNFPA Standard and Guideline # 77 & # 78, Surveys confirming no nesting or occupancy by adults or juveniles allow LOP to be adjusted.
Northern Goshawk PAC	**February 15 through September 15** (SNFPA 2004, S&G # 77 & # 79) - no timber thinning, prescribed fire, restoration projects, or road or trail building within 1/4 mile of activity center.	SNFPA Standard and Guideline # 77 & # 78, Surveys confirming no nesting or occupancy by adults or juveniles allow LOP to be adjusted; coordination with TRPA.
Bald Eagle Wintering Areas - At designated wintering sites (Baldwin/Taylor Marsh, Pope Marsh)	**October 15 through March 15** - restricts recreational access and management activities.	Emergency situations only
Bald Eagle Nesting Sites	**March 1 through August 31** - no timber thinning, prescribed fire, restoration projects, or road or trail building within 1/2 mile of active nest site per TRPA regulations (Chapter 78, Code of Ordinances)	Surveys confirming no nesting or occupancy by adults or juveniles allow LOP to be adjusted.
Osprey	**March 1 through August 15 -** no timber thinning, prescribed fire, restoration projects, or road or trail building within 1/2 mile of active nest site per TRPA regulations (Chapter 78, Code of Ordinances)	Surveys confirming no nesting or occupancy by adults or juveniles allow LOP to be adjusted.
Willow Flycatcher Sites	**June 1 Through August 31** - no timber thinning, prescribed fire, restoration projects, grazing, utilities work, or road or trail building within suitable habitat surrounding active nest	SNFPA Standard and Guideline # 58
Marten Den Site	**May 1 through July 31** (SNFPA 2004) - no timber thinning, prescribed fire, restoration projects, or road or trail building within 100 Acres (359 m) buffer	SNFPA Standard and Guideline # 88
Fisher Den Site	**March 1 through June 30** (SNFPA 2004) - no timber thinning, prescribed fire, restoration projects, or road or trail building within 700 Acres (950m) buffer	Not applicable based on survey results.
Great Grey Owl PAC	**March 1 through August 15** (SNFPA 2004) - no vegetation treatment and road construction	SNFPA Standard and Guideline # 83
Yosemite Toad Sites	Not yet determined - has not been detected in surveys in recent history	Not applicable, based on surveys

Appendix C
Best Management Practices (BMP)

This appendix details the coordination of design features and best management practices (BMPs) incorporated in the action alternatives for the South Shore project. BMPs are the management practices that have been developed to effectively protect soil and water. The design features that are included here are the project-specific actions for implementation of BMPs, and additional design features that are specific to protection of soil and water resources. These design features are also found in Chapter 2. BMPs 1-1 through 1-9 have been followed by the South Shore project interdisciplinary team during project design, and are reflected in the design features incorporated into the project.

In order to minimize impacts to water resources from the proposed activities, standard BMPs will be implemented (USDA FS 2000). In addition, project specific design features have been developed to minimize or avoid both direct and indirect negative effects of treatments on forest resources and to meet the Riparian Conservation Objectives of the LTBMU Forest Plan (1988), as amended by the Sierra Nevada Forest Plan Amendment USDA FS 2004).

Normal operating period is generally considered to be from May 15 through October 15 each year. However, operable conditions may be present outside of that time period and inoperable conditions may be present within that period. Design features may apply to one or more of the following conditions: dry soils, wet soils, frozen or snow-covered soils. (Note: the normal operating period headings may include design features that apply in wet conditions).

A listing of the design features is given below, followed by a table showing the standard BMPs. Design features for other resources found in Chapter 2 are not included here.

Project Design Features Common to both Action Alternatives

Vegetation treatments in uplands (during normal operating period)

1) Allow ground based equipment operations only when soil moisture conditions are such that compaction, rilling, and/or rutting will be minimal, or when snow conditions are at depth and temperatures, as determined by a watershed specialist, are suitable for over-the-snow operations (BMP#1-13).
2) Evaluate soil moisture conditions at the 6-10 inch depth; dry to moist soils at this depth, as determined by a USFS watershed specialist, will indicate operable moisture conditions (protocol included as part of SEZ sensitivity rating).
3) Use mechanical treatments to reduce upland hazardous fuels on slopes less than 30% and less sensitive soils.
4) Use hand treatments, end-lining or equipment reach to reduce hazardous fuels on slopes greater than 30% (BMP#5-2).
5) Where small areas of slopes greater than 30% are present in a unit, hand-fall trees and end-line the logs to a part of the unit where they can be picked up by heavy equipment.
6) No more than 15% of the treatment area shall be left with detrimental soil disturbance by skid trails and landings. If more than 15% of the soil in a given treatment area is detrimentally disturbed by skid trails and landings as estimated by a watershed specialist, the contractor shall be responsible for rehabilitating portions of the area to stay below 15% detrimental disturbance (BMP#1-15).

7) Install water bars on skid trails to provide proper drainage and prevent erosion when operations are complete and before large precipitation events (BMP#1-17). Design and spacing of water bars shall be in accordance with the Forest Service Timber Sale Administration Handbook.

8) To the extent practicable, where end-lining occurs on slopes above 10%, end-line material along slope contours (i.e. cross-slope) to avoid creating ruts in the soil that are oriented downhill. Where implementation monitoring finds potential for sediment delivery, rake in the berms from ruts created by end-lining.

Vegetation treatments in RCAs and SEZs (during and outside of normal operating periods).

9) Limit work in SEZs to the time of year when soils are dry or when operable winter conditions are present. (BMP #1-13 and 5-6).

10) Limit mechanical equipment operations in SEZs to CTL operations or operations using equipment that has been demonstrated to adequately protect soil and water resources (i.e. equipment that is lighter on the land, rubber-tired equipment, equipment that operates on a bed of slash, or other innovative technologies that reduce impacts to soils).

    a) South Shore SEZ stands that exhibit equal or less sensitivity than the Heavenly Valley Creek SEZ demonstration project (HSEZ) site based on the Sensitivity Rating System (Appendix D) may be treated with ground- based equipment under operable soil moisture conditions.

    b) SEZ stands that rate more sensitive than the HSEZ project site shall be treated by hand crews, endlining, or mechanical over-snow operations.

    c) When stands are rated more sensitive than the HSEZ site, but only a portion of the stand is responsible for the high sensitivity rating, the less sensitive part may be treated with mechanical equipment, but the sensitive portions of these stands must be treated by hand crews, endlining, or mechanical over-snow operations. Areas with wet soils or other sensitive features shall be flagged for hand treatment prior to commencement of mechanical operations.

11) Within 25 feet of perennial or intermittent streams and other water bodies (e.g.lakes, ponds) avoid tree removal methods that disturb the ground surface.

12) Flag and avoid equipment use in and adjacent to special aquatic features (springs, seeps, , and marshes); use hand treatments in these areas (BMP #1-22). See botany prescriptions for specific buffers.

13) Leave existing downed trees and LWD that are in perennial or intermittent stream channels in place unless channel stability needs dictate otherwise, as determined by an LTBMU hydrologist (LRMP Std/Gd 15).

14) Locate and burn slash piles 50 feet from any perennial or intermittent stream channel or standing water, and 10 feet from any ephemeral channel (BMP#1-22, 2-13 and 5-5).

15) Design underburning prescriptions to avoid adverse effects on soil and water resources. Plan prescribed fire to ensure that fire intensity and duration do not result in detrimentally burned soils. Flame heights shall not exceed two feet within 50 feet of stream courses or on wetlands unless higher intensities are required to achieve specific objectives. No ignition is allowed in SEZs. Fire would be allowed to back into these areas.

16) Ground based equipment in Whole Tree (WT) treatment stands shall not operate in SEZs or stream channel buffers. Treat SEZ areas within WT stands with hand crews, leaving the resulting logs in place.

17) To achieve desired fuel loading in SEZs within WT units, trees may be end-lined out of the SEZ after consultation with a watershed specialist. Slash in excess of 15 tons per acre shall be removed by hand from the 50 ft buffer from stream channels and lakes, piled and burned.

    a) Prohibit tree removal methods that disturb the ground surface within 25 ft of a perennial or intermittent stream channel or other water body (e.g. lakes, ponds).

    b) Provide ground cover adequate to prevent erosion in disturbed areas, such as slash, wood chip, or masticated material.

    c) Where implementation monitoring finds potential for sediment delivery, rake in the berms from ruts created by end-lining.

18) Ground based equipment shall not operate within 25 ft from the high water line of lakes and ponds, but may reach in to remove material.

19) Ground based equipment shall not operate within a minimum 25 ft of perennial or intermittent stream channels except at temporary or permanent stream crossings (BMP#1-19), but may reach in to remove material.

20) To avoid removing or altering bank stabilizing vegetation, trees may be marked for removal (live or dead) within 5 ft of the bank edge of perennial or intermittent streams and lakes only where fuel loads or stand densities exceed prescription and where LWD is at or above desired levels.

21) Use directional falling to keep felled trees out of intermittent and perennial streams unless the channel reach is identified as deficient in large woody debris, in which case a FS fisheries biologist and watershed specialist shall select trees greater than 12 in DBH to be felled directionally into the channel.

22) Where it is necessary to cross an area with inoperable soil moisture conditions, equipment shall operate over a slash mat, landing mat, or other protective material to minimize soil compaction.

Hand-Piling and pile burning in SEZs

23) Maintain a 50-foot buffer (no piling or burning) along perennial or intermittent streams, lakes, bogs, and fens.

24) Permit piling and burning up to 10 feet from the edge of ephemeral channels.

25) Allow fire to creep between piles and into these buffers, maintaining flame lengths of less than 2 ft in height except where sensitive plant occurrences, fens, and the noxious weeds whitetop and cheatgrass are present,

26) Place piles in a non-linear pattern in each unit where possible.

27) The maximum pile size shall not exceed 10 foot diameter by 5 foot height.

28) No more than 30% of any SEZ acre may be occupied by piles.

29) No more than 15% of any SEZ acre may be burned each year.

30) Maximize the distance between piles to the extent feasible, maintaining approximately 20 ft average spacing between piles in each unit.

31) After initial ignition of piles, but while still burning, allow each pile to be re-piled once (i.e. place large unburned pieces back into the burning pile). Additional re-piling will be allowed if necessary to achieve 80% consumption of the piled material.

32) Hot piling of burn piles is prohibited within SEZs (i.e. don't feed one pile with the material from other piles or ground material), unless necessary to meet desired fuel load conditions.

33) When piles are adjacent to aspen trees, re-piling during pile burning shall be restricted to one time per pile and hot piling is prohibited without exception.

Design features specific to the stand adjacent to the Grass Lake Research Natural Area (RNA)

34) Ground-based equipment shall stay on road 11N13 until completely inside the treatment stand boundary.

35) An erosion control fence shall be installed along the eastern edge of the road where adjacent to the culvert crossing before commencing operations.

36) Access to the treatment stand west of road 11N13 shall be limited to the time of year when the road surface is dry.

Roads (during normal operating period)

37) No new permanent roads shall be constructed.

38) New temporary roads shall be outsloped to ensure proper drainage.

39) Decommission new temporary roads after use by ripping where the rock content of the soil allows, as determined by the sale administrator (BMP#1-17 and 2-26).

40) Decommission existing and new temporary roads after use by providing ground cover such as slash, wood chip or masticated material (to a maximum 6 inch depth) and installing water bars as appropriate to prevent accumulating water on the road surface.

41) Construct and remove temporary crossings on ephemeral drainages when the channels are dry (BMP#2-16). Remove ephemeral channel crossings before the winter season begins.

42) Construct and remove temporary crossings on intermittent channels when the channels are dry and install crossings such that water flow and fish passage will not be obstructed (BMP#2-16).

43) The temporary crossing on an intermittent channel in the Saxon Creek watershed shall be constructed with a filter fabric on the bottom, a culvert shall be installed over the fabric of sufficient size to pass the winter and spring flows without causing accelerated flow downstream (approximately 18-24" diameter), and rock shall be used instead of dirt to fill in behind the culvert (BMP#2-16).

44) Construct the permanent stream crossing improvement/re-construction on Saxon Creek tributary in the fall, when the channel is not flowing. Spoil material from excavation of the existing crossing shall be kept out of the stream channel and stored outside of the floodplain meadow (BMP#2-17).

45) Place natural barriers such as large logs and rocks as needed at road entrance points to prevent continued use of decommissioned road alignments.

46) Strategically establish barriers along open areas adjacent to road or trail access (boulders, split rail fence, and barriers/signs) to discourage post-treatment establishment of user-created routes that are not designated routes.

Landings

47) Prohibit landings, fuel storage, and refueling in SEZs (BMP#1-12).

48) Prohibit landings in RCAs unless no feasible alternative exists. Allow refueling in RCAs only if no feasible alternative exists, if a spill occurs follow BMP 2-12 procedures.

49) Provide proper drainage from landings; ditching or sloping may be used where needed. (BMP#1-16).

50) Decommission landings after operations are complete in each area using the following methods:

    51) Apply wood chip or masticated material to each landing to a maximum depth of 6 inches (BMP#1-15).
    52) After chipping or mastication, rip the landing to approximately a 12 inch depth, and seed the area with a native seed mix of grasses, forbs, and shrubs (BMP#1-15). Ripping may not be possible in very rocky soils; this determination may be made by the Sale Administrator.
    53) Landings located within RCAs, and those that are greater than ¼ acre in size shall be priorities for decommissioning if the soil rock content allows.

Vegetation Treatments in uplands (outside of normal operating period)

54) When working outside of the normal operating period, conditions must be adequate to prevent erosion and detrimental soil compaction.

    a) Operable conditions must be present on at least 85% of the treatment unit[1] and generally will include the following:

        i) For frozen soil operations, a minimum 3 inch depth of frozen soil shall be maintained throughout the treatment unit and on all access roads.

        ii) For over-the-snow operations, a minimum of 12 inches of compact snow/ice shall be maintained on undisturbed ground, and 6 inches of compacted snow/ice shall be maintained on existing disturbed surfaces.

    b) Lesser depths may be agreed to by a watershed specialist and the sale administrator.

    c) Conditions that are likely to result in sedimentation to a natural water body are not considered operable.

55) If operable soil moisture conditions are present beneath a lesser snow depth (i.e. <6 inch), operations may continue until soil moisture conditions become inoperable. Use the table in the SEZ sensitivity rating to determine operable soil moisture conditions.

56) Avoid springs, seeps, and other areas that do not freeze well.

57) When working outside of the normal operating period, monitor operations regularly to ensure that adequate snow and frozen soil depths are maintained and that soil and water quality impacts are not occurring.

[1] 85% is consistent with the design feature that no more than 15% of the unit may be left in a detrimentally disturbed condition. These design features are consistent with National and Regional Forest Service policy for maintenance of soil quality.

58) Move equipment and materials to areas near pavement before conditions become inoperable.

59) For over-the-snow and frozen soil operations in SEZs, exclude ground based equipment from the 25 foot buffer around perennial and intermittent channels.

60) Temporary crossings on intermittent or ephemeral channels may be approved on a case by case basis through agreement between the sale administrator and a watershed specialist, and the conditions of the agreement shall be documented. These crossings shall not result in bank damage or water quality impairment.

Roads (outside of normal operating period)

61) Unless adequate snow cover or frozen soil conditions exist, where a native surface road meets a paved road, the road intersection must be covered with rock or organic material to prevent tracking of mud onto the paved road.

62) If a native surface road becomes rutted, close the road unless spot-rocking or other mitigation of rutted areas will be effective in preventing road damage. Rutting is defined as two-inch deep depressions, over 10% or more of the road surface, on a per mile basis.

63) Rutting of a road, forwarder trail, or any other disturbance that can deliver sediment into a water body or SEZ must be avoided.

64) During winter operations, paved surfaced roads may be plowed, including turnouts, if the action will not cause damage to the road surface and associated drainage structures.

65) On native surface roads, retain a minimum of 6 inches of compacted snow on 85% or more of the road surface after plowing to facilitate freezing. During road use, a minimum of 6 inches of compacted snow must be present on 85% or more of the road surface, unless the road surface is frozen to a depth of 3 inches or more. Ensure that plowing does not damage drainage structures.

66) Road alignments within the contract area that require snow removal shall be visibly marked on both sides along the entire alignment to facilitate plowing. Excess snow removed during plowing shall not be placed into drainages or riparian areas.

67) Before over-the-snow operations begin, mark existing culvert locations. During and after operations, ensure that all culverts and ditches are open and functional.

68) When roads are plowed, snow berms must be breached to allow drainage during snowmelt. Space outlets so as not to concentrate road surface flows (usually spaced at a minimum of every 300 feet). Erosion control structures may be necessary at outlets to collect road generated sediment, and will be agreed to by the sale administrator and watershed specialist.

Summary Best Management Practices (BMPs)

Best Management Practice	Description
BMP 1-1: Timber sale planning process (TSPP)	Earth scientists or other trained individuals will evaluate onsite watershed characteristics and the potential environmental consequences of activities related to the proposed timber harvest activities. They will design the timber sale to include site-specific prescriptions for each area of water quality concern.
PSW Region BMP 1-2: Timber harvest unit design	Earth scientists or qualified specialists will conduct a hydrologic and geologic survey of the area affected by proposed harvest activities. Mitigations or changes needed to stabilize slopes or improve streamcourses will be incorporated into the harvest unit design.
PSW Region BMP 1-3: Determination of erosion hazard rating (EHR) for timber harvest unit design	Use the EHR System developed by the California Soil Survey Committee to evaluate the potential erosion hazard of proposed timber harvest units during the pre-sale planning process, and use this information to help design the timber sale and to select appropriate erosion control measures.
PSW Region BMP 1-4: Use of sale area maps (SAMs) for designating water quality protection needs	The Interdisciplinary Team (IDT) will identify and delineate water quality protection features, such as the location of streamcourses and riparian zones to be protected, wetlands to be protected, boundaries of harvest units, and roads where log hauling is prohibited or restricted, as part of the environmental documentation process. The Sale Preparation Forester will include them on the SAM at the time of contract preparation.
PSW Region BMP 1-5: Limiting the operating period of timber sale activities	Limited operating periods will be identified and recommended during the TSPP by the IDT. Purchaser must submit a general plan of operation which will identify planed periods for, and methods of road construction, timber harvesting, completion of slash disposal, erosion control work and other contractual requirements. The purchaser will provide an annual schedule of anticipated activities. Limited operating period will be used to limit the purchaser’s operation to specified periods when adverse environmental effects are not likely.
PSW Region BMP 1-6: Protection of unstable lands	The IDT will prepare plans and environmental documents, utilizing information provided from specialists trained and qualified to identify unstable areas. Where unstable lands are presently classified as suitable forest lands, the classification is changed to unsuitable forest lands, which will not be harvested until they can be harvested without irreversible adverse effects to soils, productivity, or watershed conditions.
PSW Region BMP 1-8: Streamside management zone designation	Roads, skid trails, landings and other timber harvesting facilities will be kept at a prescribed distance from designated stream courses. Factors such as stream class, channel aspect, channel stability, sideslope steepness, and slope stability will be considered in determining the activities limited within Streamside Management Zones (SMZs). Aquatic and riparian habitat, beneficial riparian zone function, and their condition and estimated response to the proposed timber sale will also be evaluated in designating the SMZ.

PSW Region BMP 1-9: Determine tractor loggable ground**	To minimize soil erosion and subsequent sedimentation and water quality degradation resulting from ground disturbance of logging systems. To determine tractor loggable ground, consider physical site characteristics such as steepness of slopes and soil properties. The Erosion Hazard Rating is one method that can be used.
PSW Region BMP 1-10: Tractor skidding design**	Watershed factors such as slope, soil stability, exposure, SMZs, meadows, and other factors that may affect surface water runoff and sediment yield potential will be considered when designing skidding patterns. The careful control of skidding patterns serves to avoid onsite and downstream channel instability, build-up of destructive runoff flows, and erosion in sensitive watershed areas such as meadows and SMZs.
PSW Region BMP 1-12: Log landing location	Landing locations proposed by the purchaser or their representatives must be agreed to by the Sales Administrator (SA). An acceptable landing will be evaluated according to a set of criteria that includes the following: the cleared or excavated size of landings should not exceed that needed for safe and efficient skidding and loading operations; landing locations that involve the least amount of excavation and the least erosion potential will be selected; landings will be located near ridges away from headwater swales, in areas that will allow skidding without crossing stream channels or causing direct deposit of soil and debris to the stream; landings will be located where the least number of skid roads will be required, and sidecast material can be stabilized without entering drainages; skid approach will be as nearly level as feasible; and the number of skid trails entering a landing will be minimized.
PSW Region BMP 1-13: Erosion Prevention and Control Measures During Timber Sale Operations	Equipment will not be operated when ground conditions are such that excessive damage will result. Erosion control measures will be kept current, which means daily, if precipitation is likely, or at least weekly, when precipitation is predicted.
PSW Region BMP 1-14: Special Erosion Prevention Measures on Disturbed Lands	Where required by the contract, the purchaser will give adequate treatment by spreading slash, mulch, wood chips, or some other treatment (if agreed upon) on portions of tractor roads, skid trails, landings, cable corridors, or temporary road fills. This provision is to be used only for timber sales that contain special soil stabilization problems that are not adequately treated by normal methods.
PSW region BMP 1-15: Revegetation of Areas Disturbed by Harvest Activities	Where soil has been severely disturbed and the establishment of vegetation is needed to control accelerated erosion, the purchaser will be required to establish an adequate ground cover of grass or other vegetative stabilization measures approved by the USFS.
PSW Region BMP 1-16: Log Landing Erosion Prevention and Control	Timber Sale Contract (TSC) requirements provide for erosion prevention and control measures on all landings, which will include provisions for proper drainage. After landings have served purchaser's purpose, the purchaser will ditch or slope the landings and may be required to rip or subsoil and make provisions for revegetation to permit the drainage and dispersal of water.
PSW Region BMP 1-17: Erosion Control on Skid Trails	To protect water quality by minimizing erosion and sedimentation derived from skid trails, erosion control measures are required on a skid trails, tractor roads, and temporary roads. Normally, such measures

	involve constructing cross ditches and water spreading ditches. The location of all erosion control measures are designated and agreed to on the ground by the SA.
PSW Region BMP 1-18: Meadow Protection	At a minimum, meadow protection requirements contained in Forest Land and Resource Management Plans must be identified and implemented. Unauthorized operation of vehicular or skidding equipment in meadows or in protection zones is prohibited by the TSC. Damage to designated meadows and/or their associated protection zones will be repaired by the purchaser in a timely manner, as agreed to by the SA. Damage to a streamcourse or streamside management zone (SMZ) caused by unauthorized purchaser operations will be repaired by the purchaser in a timely manner and agreed upon manner.
PSW Region BMP 1-19: Streamcourse Protection (Implementation and Enforcement)	Streamcourse protection principles including but not limited to the following will be carried out: location and method of streamcourse crossings must be agreed to by the SA prior to construction; all damage to streamcourses, including banks and channels, must be repaired to the extent practicable; all debris generated by the project will be removed from streamcourses in an agreed upon manner that will cause the least disturbance; equipment use in SMZs will be limited or excluded; water bars and other erosion control structures will be located to disperse concentrated flows and filter out sediments prior to entry into a streamcourse; and material from temporary road and skid trail streamcourse crossings will be removed and streambanks restored to the extent practicable.
PSW Region BMP 1-20: Erosion Control Structure Maintenance	During the period of the TSC, the purchaser will provide maintenance of soil erosion structures constructed by purchaser until they become stabilized, but not for more than 1 year after their construction. After 1 year, needed erosion control maintenance will be accomplished using other funding sources under TSC provisions B6.6 and B6.66.
PSW Region BMP 1-21: Acceptance of Timber Sale Erosion Control Measures Before Sale Closure	“Acceptable” erosion control means only minor deviation from established objectives, so long as no major or lasting damage is caused to soil or water. SAs will not accept erosion control measures that fail to meet these criteria.
PSW Region BMP 1-22: Slash Treatment in Sensitive Areas	Special slash treatment site preparation will be prescribed in sensitive areas to facilitate slash disposal without the use of mechanized equipment.
PSW Region BMP 1-25: Modification of Timber Sale Contract	Once timber sales are sold, they are harvested as planned in the TSC. Occasionally, however, it will be necessary to modify a TSC due to new concerns about the potential affects of land disturbance on a water resource. Where the project is determined to unacceptably affect watershed values, the appropriate Line Officer will take corrective actions, which may include contract modification.
PSW Region BMP 2-1: General Guidelines for the Location and Design of Roads	Location, design and construction of roads will be agreed upon by the IDT in order to result in minimal resource damage.

PSW Region BMP 2-2: Erosion Control Plan	Within a specified period after the award of a contract (currently 60 days prior to the first operating season), the purchaser will submit a general plan that, among other things, establishes erosion control measures. Operations cannot begin until the Forest Service has approved the plan in writing.
PSW Region BMP 2-3: Timing of Construction Activities	Temporary road construction and road re-construction activities will be conducted during the dry season, when rain and runoff are unlikely and weather and ground conditions are such that impacts to soils and water quality will be minimal. Construction of drainage facilities and performance of other contract work to control erosion and sedimentation is required in conjunction with earthwork projects. The operator shall limit the amount of area being graded at a site at any one time, and shall minimize the time that an area is left bare.
PSW Region BMP 2-4: Stabilization of Road Slope Surfaces and Spoil Disposal Areas	To minimize or prevent erosion from exposed cut slopes, fill slopes, and spoil disposal areas using bioengineering and other techniques. Depending on site factors such as slope angle, soil type, climate, and proximity to waterways, many fill slopes, some cut slopes, and some spoil disposal areas will require vegetative and/or mechanical measures to provide surface soil stability.
PSW Region BMP 2-5: Road Slope Stabilization Construction Practices	To reduce sedimentation by minimizing erosion from road slopes and slope failure along roads. Plan all road construction considering adequate stabilization needs.
PSW Region BMP 2-6: Dispersion of Subsurface Drainage From Cut and Fill Slopes	To minimize the possibilities of cut or fill slope failure and the subsequent production of sediment. Sine the angle and height of cut and fill slopes can increase the risk of instability, it is often necessary to provide subsurface drainage to avoid moisture saturation and subsequent slope failure.
PSW Region BMP 2-7: Control of Road Drainage	Used alone or in combination, methods such as the construction of properly spaced cross drains, water bars, or rolling dips; installation of energy dissipaters, aprons, downspouts, gabions, or flumes; armoring of ditches and drain inlets and outlets; and removing or adding berms can be used to control unacceptable effects of drainage.
PSW region BMP 2-9: Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects	Apply protective measures to all areas of disturbed, erosion-prone, unprotected ground that is not to be further disturbed in the present year. Affected areas can include roads, road fills, skid trails, landings, stream crossings, bridge excavations, and firelines. Preventative measures include removal of temporary culverts, culvert plugs, diversion dams, or elevated stream crossings; installation of temporary culverts, side drains, cross drains, diversion ditches, sediment basins, berms, or other facilities needed to control erosion; removal of debris, obstructions and spoil material from channels and floodplains; and planting vegetation, mulching, and/or covering exposed surfaces with jute mats or other protective material.

PSW Region 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. Design and construct the roadway with a proper slope ratio and with adequate strength to support the treadway, shoulders, subgrade and the roads traffic loads. Construct embankments using one of the following methods: sidecasting and end-dumping, layer placement, controlled compaction, and/or using retaining walls, confinements systems, plantings, or combination.
PSW Region BMP 2-11: Control of sidecast material during construction and maintenance	To minimize sediment production originating from sidecast material during road construction or maintenance, loose, unconsolidated material must not be permitted to enter SMZs. Sidecasting is an unacceptable construction alternative in areas where it can adversely impact water quality. Prior to the start of construction or maintenance activities, waste areas must be located where excess material can be deposited and stabilized.
PSW Region BMP 2-12: Servicing and refueling equipment	If the volume of fuel exceeds 660 gallons in a single container, or if total storage at a site exceeds 1,320 gallons, project Spill Prevention, Containment, and Counter Measures (SPCC) plans are required. Operators are required to remove service residues, waste oil, and other materials from National Forest land and be prepared to take responsive actions in case of a hazardous substance spill, according to the SPCC plan.
PSW Region BMP 2-13: Control of construction and maintenance activities adjacent to SMZs	Construction and maintenance fills, sidecast, and end-hauled materials are kept out of SMZs except at designated sites to minimize effects on the aquatic environment. It is also necessary to stabilize fill slopes to prevent sediment accumulations in the streamside zone.
PSW Region BMP 2-14: Controlling in-channel excavation	When necessary in the construction or removal of culverts, bridges, and other facilities, heavy equipment is permitted to cross or work in or near streams or lakes during construction under specific protection requirements. Excavation during the installation of instream structures must follow all of the following minimum water quality protection requirements: 1) Unless otherwise approved, no excavation will be made outside of caissons, cribs, cofferdams, or sheet piling; 2) the natural streambed or lake bottom adjacent to the structure will not be disturbed without prior approval of the ER or COR; 3) If any excavation or dredging is made at the site of the structure before it is sunk in place, all excavations will be restored to the original surface and the streambed or lake bottom must be protected with suitable material; 4) material deposited within the stream or lake area from foundation or other excavation will not be discharged into live streams or lakes, but will be put into settling areas as shown in plans or approved by the ER or COR; 5) If the channel or lake bottom is disturbed during construction, it must be restored to its original configuration while minimizing any additional disturbance; and, 6) disturbance of stream or lake banks are kept to a minimum. Disturbed banks are stabilized.
PSW Region BMP 2-15: Diversion of flows around construction sites	Streamflow must be diverted around construction sites such as bridges, culverts, and dams for all live streams. The diverted flows are returned to their natural streamcourse as soon as possible after construction or prior to the rainy season. All disturbed areas are stabilized prior to the rainy season or as needed.

PSW Region BMP 2-16: Stream crossings on temporary roads	Stream crossing structures are required on all temporary roads where it is necessary to cross designated channels. Such crossings are designed to provide for unobstructed flows and the passage of fish, and to minimize damages to stream channels and water quality. The number of crossings will be kept to the minimum needed for access and will be as perpendicular to stream courses as possible. Temporary crossing facilities will be removed and the site stabilized prior to the rainy season each year or when the facility is no longer needed.
PSW Region BMP 2-17: Bridge and culvert installation	Spoil material from excavation during construction of in-channel structures should neither obstruct the stream course or natural floodplain nor impair the efficiency of the installed structure. Excavated material should be kept out of stream channels, stockpiled material on floodplains should be removed prior to a storm event, and flowing water should be diverted around work sites.
PSW Region 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 and ensure that debris jams are not formed which obstruct fish passage or could result in downstream damage from high water flow surges after dam failure. Construction debris and other generated roadside slash developed along roads in SMZs shall be disposed of by: 1) onsite piling and burning, burying, chipping, scattering, disposal in cutting units, windrowing at the base of slopes, or incorporation (only in temporary roads); 2) removal to agreed locations; 3) a combination of the above; and 4) large limbs and logs are removed to designated sites outside the SMZ or relocated within the SMZ to meet aquatic resource management
PSW Region BMP 2-21: Water source development consistent with water quality protection	Water source development to supply water for road construction and maintenance, dust control, and fire control shall avoid use of earth fill and dam construction. Cofferdams and water holes will be built out of sandbags filled with clean sand or gravel. Downstream water flow will not be reduced to a level that will be detrimental to established uses.
PSW Region BMP 2-22: Maintenance of roads	Provide the basic maintenance required to protect the road and to ensure that damage to adjacent land and resources is prevented. This is the normal prescription for roads closed to traffic and often requires an annual inspection to determine what work is needed. At a minimum, maintenance must protect drainage facilities and runoff patterns. Additional maintenance includes surfacing and resurfacing, outsloping, clearing debris, etc.
PSW Region BMP 2-23: Road surface treatment to prevent loss of materials	When necessary, contractors, purchasers, special users, and Forest Service project leaders will undertake road surface treatment measures such as watering, sealing, aggregate surfacing, or paving to minimize loss of road materials.
PSW Region BMP 2-24: Traffic control during wet periods	Roads that must be used during wet periods should have a stable surface and sufficient drainage to allow use while also maintaining water quality. Rocking, paving, and armoring are measures that protect the road surface and reduce soil loss. Where wet season field operations are planned, roads may need to be upgraded, use restricted to low ground pressure vehicles or frozen ground conditions, or maintenance intensified to handle the traffic without creating excessive erosion and

	damaging the road surface.
PSW Region BMP 2-25: Snow removal controls to avoid resource damage	Where Forest Roads are used throughout the winter, the contractor will be responsible for snow removal that will protect roads and adjacent resources. Rocking or other special surfacing will be necessary before the operator is allowed to use the roads. Snow berms will be removed where they result in accumulation or concentration of snowmelt runoff on the road and erosive fill slopes. Snow berms will be installed in places that will preclude concentration of snowmelt runoff and that will serve to rapidly dissipate melt water.
PSW Region BMP 2-26: Decommission of roads	Temporary roads will be obliterated or decommissioned following their intended use. Obliteration/decommissioning may include re-contouring or outsloping to return the road prism to near natural hydrologic function, blocking the road to vehicle access, removing crossings and restoring natural drainage, and stabilizing road surfaces with ripping and/or revegetation.
PSW Region BMP 5-2: Slope limitations for mechanical equipment operations	Ground based equipment operation will be limited to slopes where corrective measures such as water bars can be effectively installed to reduce gully and sheet erosion and associated sediment production.
PSW Region BMP 5-3: Tractor operation limitation in wetlands and meadows	Mechanical equipment will be excluded from wetlands and meadows except for the purpose of restoring wetland and meadow function. The target areas will be protected from mechanical operations except when they are identified for treatment by trained and qualified personnel on the IDT. Specific protection measures will be established for each area that could incur adverse water quality impacts.
PSW Region BMP 5-4: Revegetation of surface disturbed areas	On unstable soil surfaces resulting from project activities, revegetation with native seed and/or application of mulch may be required to protect water quality and minimize soil erosion. The onsite factors evaluated will include soil productivity, topography, EHR, and soil water holding capacity.
PSW Region BMP 5-5: Disposal of organic debris	The project IDT will determine the methods of debris disposal and/or placement of debris after treatment. Methods of disposal include: prescribed burning, chipping, mastication, lop and scatter, and mechanical harvesting/collection.
PSW Region BMP 5-6: Soil moisture limitations for mechanical equipment operations	To prevent compaction, gullying and rutting, mechanical equipment operations will be limited or excluded during wet soil conditions.
PSW Region BMP 5-12: Streamside wet area protection during pesticide spraying	When spraying pesticides for the purpose of meeting non-riparian area land management objectives, an untreated strip of land and vegetation will be left alongside surface waters, wetlands, riparian areas, or SMZs. When spraying pesticides for purposes of meeting with riparian are land management objectives, localized buffers around target species will be established and only hand application will be used. (see discussion on use of Sporax to prevent disease in Chapters 2 and 3)

PSW Region BMP 6-1: Fire and fuel management activities	To reduce public and private losses and environmental impacts that result from wildfires and/or subsequent flooding and erosion, measures including the use of prescribed fire or mechanical methods will be used to achieve defensive fuel profile zones, fuel reduction units, and fire suppression activities.
PSW Region BMP 6-2: Consideration of water quality in formulating fire prescriptions	To ensure water quality protection while achieving management objectives through the use prescribed fires, prescription elements will include, but not be limited to, factors such as fire weather, slope, aspect, soil moisture, and fuel moisture. The prescription will include at the watershed and subwatershed level the optimum and maximum burn block size, aggregated burned area, acceptable disturbance for contiguous and aggregate length for the riparian/SMZ, and maximum expected area covered by water repellent soils.
PSW Region BMP 6-3: Protection of water quality from prescribed burning effects	Implementation of techniques to prevent water quality degradation, maintain soil productivity, and minimize erosion from prescribed burning. These techniques include: constructing water bars in fire lines, reducing fuel loading in drainage channels, and retaining or re-establishing ground cover as needed to keep erosion of the burned site within the limits of the burn plan.
PSW Region BMP 7-1: Watershed restoration	To repair degraded watershed conditions and improve water quality and soil stability, utilize the following watershed restoration techniques: improve ground cover density, improve infiltration, and improve overall watershed function.
PSW Region BMP 7-3: Protection of wetlands	Activities and new construction in wetlands will not be permitted whenever there is a practical alternative. Factors relevant to the survival and quality of the wetlands, such as water supply, water quality, recharge areas, habitat diversity and stability, and hydrologic function of riparian areas will be considered when evaluating proposed actions in wetlands. Replacement in kind of lost wetlands should be evaluated to apply a “no net loss” perspective to wetland preservation.
PSW Region BMP 7-4: Forest and hazardous substance spill prevention control and counter-measure (SPCC) plan	To prevent contamination of waters from accidental spills, a Spill Prevention Containment and Counter Measures (SPCC) Plan must be prepared if the total oil products on site in above-ground storage exceed 1320 gallons, or if a single container exceeds 660 gallons.
PSW Region BMP 7-7: Management by closure to use	If the Forest Supervisor determines that a particular resource or improvement needs protection from use to preclude adverse water quality effects, activities that could result in damages to those resources or improvements may be excluded.
PSW Region BMP 7-8: Cumulative off-site watershed effects	Cumulative Watershed Effects (CWE) analyses are used to protect identified beneficial uses of water from the combined effects of multiple management activities.

Appendix D

Stream Environment Zone Sensitivity Rating System

March 2008

This rating system was designed to evaluate the sensitivity of treatment units within fuel reduction projects that either contain or are entirely SEZ. The results from the rating exercise for each SEZ treatment unit proposed for mechanical treatment within the South Shore project will be compared to the sensitivity rating for the Heavenly Creek SEZ demonstration project site (HSEZ) using the same criteria. If South Shore units have an equal or higher rating than the HSEZ site, they will either be considered for more intensive monitoring to evaluate the impacts of mechanical equipment operations, or could be changed to hand treatment.

The following assumptions apply to this rating system:

- USFS LTBMU Forest Plan and Sierra Nevada Framework standards and guidelines will be met.
- All timber management, road and building site construction, vegetation manipulation, fire suppression and fuels management, and watershed management BMPs found in the BMP guidebook, water quality management for Forest System lands in California (USDA FS 2000) will be followed.
- Sierra Nevada Forest Plan Amendment (SNFPA, 2004) riparian conservation objectives will be met.

1st determine if the SEZ proposed for mechanical treatment exhibits the following characteristics that would make it **NOT** suitable for mechanical treatment:

- If the average slope or slope range throughout the SEZ is ≥30%, or
- If slopes are unstable and greater than 20%, with less than 15 ft of floodplain width to act as a buffer, or
    - Slopes are considered unstable if they are in poor condition as defined by the TRPA Code of Ordinances – Slopes show evidence of active and pronounced surface (sheet, rill, gully) erosion or mass wasting over more than 50 percent of the slope surface. Slopes are typically covered less than 50 percent with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Soil horizons are typically non-cohesive and unconsolidated. Evidence of seeping is often present.
- If soil moisture content and the associated compaction risk (varies based on soil texture) fall within the highlighted sections of the following table, or
- If the entire unit is not accessible with ground based equipment (based on size and extent of wet areas, boulders, steep slopes, etc.).

Protocol for determining operability of soils based on soil moisture at 6-10" depth

	Coarse Soils	**Light Soils**	**Med. Soils (<35% clay)**	**Heavy Soils (>35% clay)**
Soil Moisture % Increases Downward	Loamy sands, fine sand loam, very fine sands, coarse sands	Fine sandy loams, sandy loams, very fine sandy loam	Sandy clay loam, loam, silt loam, sandy clay loam, clay loam	Clay loam, sandy clay, silty clay loam, clay
Dry soils	Dry, loose, single grained flows thru fingers	Dry, loose, flows thru fingers	Powdery, dry, sometimes slightly crusted but breaks down into powdery conditions	Hard, baked, cracked sometimes has loose crumbs on surface
Moist soil	Still appears dry, will not form a ball with pressure	Still appears to be dry; will not form a ball	Somewhat crumbly, but will hold together from pressure	Somewhat pliable; will form ball under pressure. At plastic limit.
Moist soil	Still appears dry, will not form a ball with pressure	Tends to ball under pressure but seldom will hold together	Forms a ball and is very pliable, sticks readily if high in clay.	Easily ribbons out between fingers, has a slick feeling. At plastic limit.
Very moist soil	Tends to stick together slightly, sometimes forms a very weak ball	Forms a weak ball breaks easily, will not stick. Plastic limit or nonplastic.	Forms a ball and is very pliable, sticks readily if high in clay. Exceeds plastic limit.	Easily ribbons out between fingers, has a slick feeling. Exceeds plastic limit.
Wet soils	Upon squeezing, free water may appear. Wet outline is left on hand. Nonplastic.	Upon squeezing free water may appear. Wet outline left on hand.	Can squeeze out free water. Wet outline left on hand.	Puddles and free water forms on surface. Wet outline left on hand.

Recommended not operable by USFS Regional Soil Scientist

Proposed additional restriction based on Bob Powers (USFS PSW Soil Scientist) comment

Once the unit is determined to be suitable for mechanical treatment based on the above mentioned criteria, then rate each SEZ unit for the level of sensitivity (i.e. higher numerical score indicates a higher level of sensitivity):

1) Does this SEZ contain or share a boundary with any of the following special aquatic features: lakes, bogs, fens, vernal pools, and/or springs?
   a. If no…0
   b. If yes, but features could be flagged and avoided…(2)
   c. If yes, and could not be flagged and avoided…Not appropriate for mechanical operations.

   Score________

2) Does the treatment unit have a stream/defined channel within its bounds or in close proximity to the unit?
   a. If no…0 (Skip to #3)
   b. If yes, and the channel is perennial…What is the channel type, based on Rosgen's classification?

i. Aa+ - Very steep (>10%), deeply entrenched, debris transport, torrent streams. Very high relief. Vertical steps with deep scour pools, waterfalls. Low width to depth ratio, totally confined, sinuosity 1 to 1.1. Risky for mechanical treatment. (5)

ii. A – Steep (4-10%), entrenched, cascading, step/pool streams. High energy, debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel. High relief, confined, frequently spaced deep pools. Low width to depth ratio, sinuosity 1 to 1.2. Risky for mechanical treatment. (5)

iii. B – Moderately entrenched, moderate gradient (2-3.9%), riffle dominated channel, with infrequently spaced pools. Very stable plan and profile, stable banks. Moderate relief, colluvial deposition, and/or structural. Moderate width to depth ratio. Narrow, gently sloping valleys, rapids predominate with scour pools. Sinuosity >1.2. Little risk associated with treating these areas with mechanical equipment. (3)

iv. C – Low gradient (<2%), meandering, point bar, riffle/pool, alluvial channels with broad, well defined floodplains. Broad valleys with terraces, in association with floodplain. Slightly entrenched, sinuosity >1.4. If soils are dry, little risk associated with treating these SEZ mechanically. (3)

v. D – Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks and bed. Broad valleys with alluvium, steeper fans. Glacial debris and depositional features. Active lateral adjustment with abundant sediment supply. High risk associated with bringing heavy equipment into these dynamic systems. (5)

vi. DA – Anastomosing (multiple channels) narrow and deep with extensive, well vegetated floodplains and associated wetlands. Very gentle relief with variable sinuosities and width to depth ratios. Very stable streambanks. Broad, low gradient valleys with fine alluvium or lacustrine soils. Very low bedload, high wash load sediment. Some risk associated with heavy equipment operations near these channels. (4)

vii. E – Low gradient (<2%), meandering riffle/pool stream with low width to depth ratio and little deposition. Very efficient and stable, high meander width ratio. Broad valley/meadows. Alluvial materials with floodplains. Highly sinuous (>1.5) with stable, well vegetated banks. If soils are dry, little risk in treating these SEZs mechanically. (3)

viii. F – Entrenched, meandering riffle/pool channel on low gradients (<2%) with high width to depth ratio. Entrenched in highly weathered material. Meandering, laterally unstable with high bank erosion rates. Sinuosity >1.4. Treatment could be risky near banks. (4)

ix. G – Entrenched gully step/pool and low width to depth ratio on moderate gradients (2-3.9%). Narrow valleys or deeply incised in alluvial or colluvial materials (i.e. fans or deltas). Unstable, with grade control problems and high bank erosion rates. Sinuosity >1.2. Risky for mechanical treatment. (5)

Score__________

b. If yes, and the channel is intermittent…

i. Are the banks defined and stable [stability is defined as channel characteristics (rocks, overflow channels, woody material) being adequate to dissipate energy, vegetation on banks, vertical stability, and/or no visible signs of excessive erosion or deposition (TR 1737-15 1998)] (2)

ii. Defined and unstable (instability is defined as lacking the above listed characteristics) (3)

iii. Undefined (1)

Score___________

c. If yes, and the channel is ephemeral…

i. Are the banks defined and stable (1)

ii. Defined and unstable (2)

iii. Undefined (0)

Score___________

3) If the unit is adjacent to perennial channels or lakes, and the slope between the treatment unit and the channel/lake is >20% with less than 15 ft of floodplain width to act as a buffer, <u>or</u> slopes are >30%…(1)

Score__________

4) Adjacent to perennial channels where treatment would occur on the slope, if slopes are stable and >20% with little to no floodplain width to act as a buffer, <u>or</u> slopes are unstable and <20% with little to no floodplain width…
   - If the risk associated with mechanical treatment in these areas could be mitigated or reduced with the application of more rigorous BMPs…(1)
   - If the application of more rigorous BMPs would not reduce or mitigate mechanical treatment effects (or are not chosen to be applied)...(2)

Score__________

5) How many stream crossings would be necessary to treat the SEZ with mechanical equipment?
   - If no crossings are necessary, 0
   - If 1 crossing for every 800 ft of channel could be used (for ephemeral or intermittent channels)…(1)
   - If 1 crossing for every 800 ft of channel could be used (for perennial channels)…(3)

- If more than 1 crossing is needed for every 800 ft of channel (for ephemeral or intermittent channels)…(2)
- If more than 1 crossing is needed for every 800 ft of channel (for perennial channels)…(5)

Score__________

Appendix E

VQO and Scenic Design Criteria

VQO	Scenic Class	Visibility Zone	Treatment Design Features
Retention	1	Foreground (up to ½ mile)	Retain up to 15% of existing smaller trees and shrubs; maintain irregular spacing and clumping distribution between trees and groups of trees. Retain largest non-hazard tree snags at a rate of 3-6 per acre where possible. Cut stumps at 6” maximum height. Avoid hand piles within 100 feet of travel routes. Screen hand-piles behind large trees within 100-200 feet of travel routes. Provide soil cover on staging areas, landings or other cleared areas to blend visually with the surrounding landscape.
Retention	2	Foreground (up to ½ mile)	Retain up to 15% of existing smaller trees and shrubs; maintain irregular spacing and clumping distribution between trees and groups of trees. Retain largest non-hazard tree snags at a rate of 3-6 per acre where possible. Cut stumps at 6” maximum height. Avoid hand piles within 100 feet of travel routes. Screen hand-piles behind large trees within 100-200 feet of travel routes. Provide soil cover on staging areas, landings or other cleared areas to blend visually with the surrounding landscape.
Retention	1 and 2	Middle / Background	Retain up to 15% of existing smaller trees; maintain irregular spacing and clumping distribution between trees and groups of trees. Retain largest non-hazard tree snags at a rate of 3-6 per acre where possible. Cut stumps at 6” maximum height. Screen hand-piles behind large trees. Provide soil cover on staging areas, landings or other cleared areas to blend visually with the surrounding landscape.
Partial Retention	1	Foreground (up to ½ mile)	Retain up to 15% of existing smaller trees and shrubs; maintain irregular spacing and clumping distribution between trees and groups of trees. Retain largest non-hazard tree snags at a rate of 3-6 per acre where possible. Cut stumps at 6” maximum height. Avoid hand piles within 50 feet of travel routes. Screen hand-piles behind large trees within 50-200 feet of travel routes. Provide soil cover on staging areas, landings or other cleared areas to blend visually with the surrounding landscape.
Partial Retention	2	Foreground (up to ½ mile)	Retain up to 15% of existing smaller trees and shrubs; maintain irregular spacing and clumping distribution between trees and groups of trees. Retain largest non-hazard tree snags at a rate of 3-6 per acre where possible. Cut stumps at 6” maximum height Screen hand-piles behind large trees within 200 feet of travel routes. Provide soil cover on staging areas, landings or other cleared areas to blend visually with the surrounding landscape.
Partial Retention	1 and 2	Middle / Background	Retain up to 15% of existing smaller trees; maintain irregular spacing and clumping distribution between trees and groups of trees. Retain largest non-hazard tree snags at a rate of 3-6 per acre where possible. Provide soil cover on staging areas, landings or other cleared areas to blend visually with the surrounding landscape.