United States
Department of
Agriculture

Forest Service

Pacific
Southwest
Region

R5-MB-231A

August
2011

Final
Environmental Impact Statement

South Shore Fuel Reduction and Healthy Forest Restoration

Lake Tahoe Basin Management Unit

Cover photo:

Wildland-Urban interface/intermix of National Forest System lands managed by the Lake Tahoe Basin Management Unit and neighborhoods within the City of South Lake Tahoe. Lake Tahoe, as viewed to the northwest from the intersection Ski Run Blvd and Pioneer Trail.

FINAL
ENVIRONMENTAL IMPACT STATEMENT

Lake Tahoe Basin Management Unit South Shore Fuel Reduction and Healthy Forest Restoration El Dorado County, California

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Abstract: The South Shore Fuel Reduction and Healthy Forest Restoration Final Environmental Impact Statement (FEIS) documents the analysis of three alternatives (1, 2, and 3) to manage fuel loading 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.
- Alternative 2 would use mechanical equipment on more acres, including within SEZs and wildlife areas of the three alternatives.

Alternative 3 was developed in response to public comments received during scoping on the Proposed Action.

- Alternative 3 would reduce impacts to watersheds and wildlife compared to Alternative 2, while still reducing the risk of high-intensity crown fire.
- Alternative 3 reduces hazardous fuel and improves forest health in the WUI on 10,112 acres.

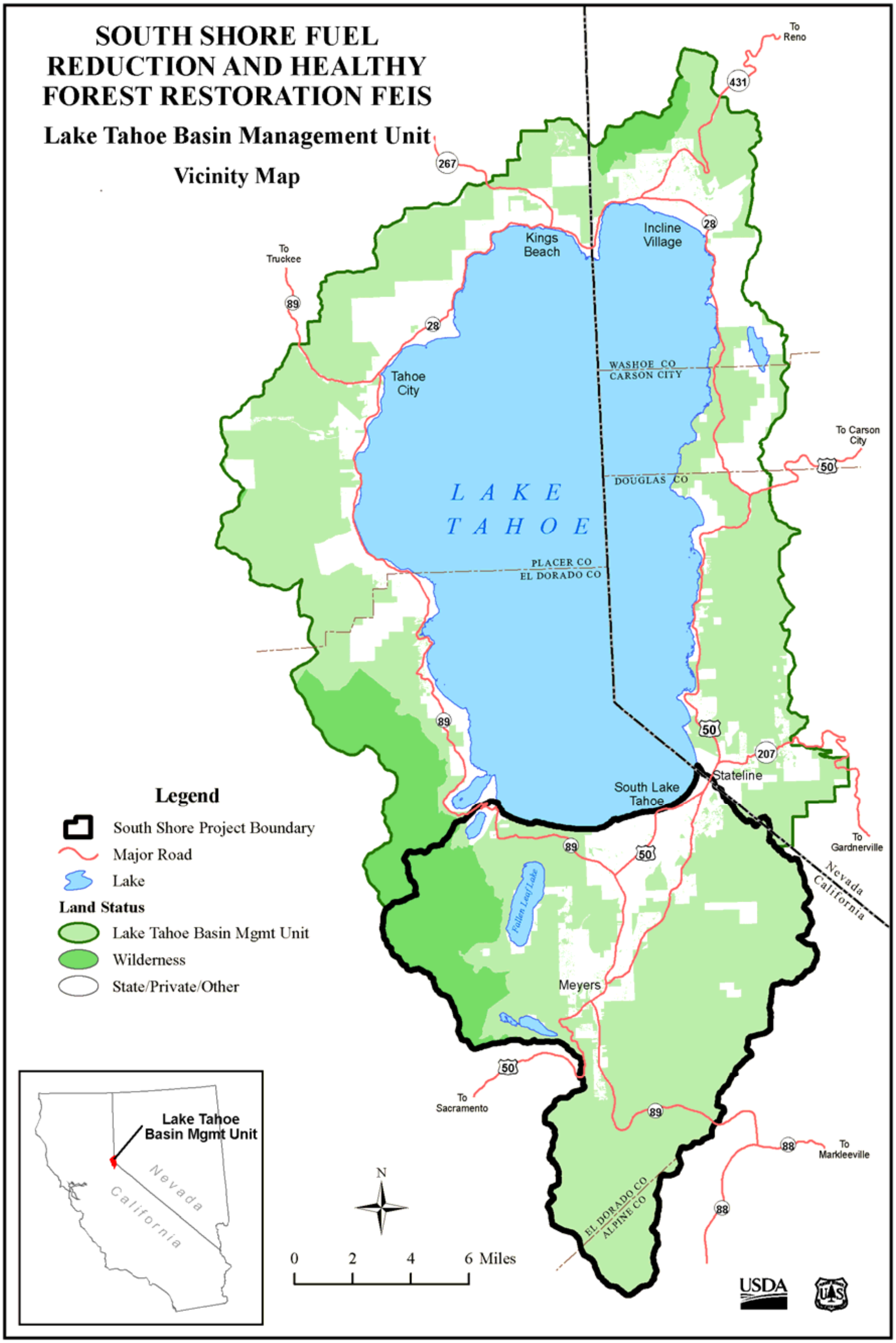

Figure 1. South Shore Project Vicinity within the Lake Tahoe Basin

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Executive Summary

The Lake Tahoe Basin Management Unit (LTBMU) proposes to reduce the risk of high intensity wildfire on National Forest System lands in the wildland urban interface (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. Equally important is thinning trees to achieve forest density more resistant to drought, insects, and disease which is included in the action alternatives, along with removal of conifer encroachment in riparian areas, aspen groves, and meadows. The action alternatives were developed using the best available science and 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.

Table ES-1. Acres of Ownership in Project Analysis Area

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

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 interface (WUI) that exceed desired conditions as defined by the Forest Plan (Sec.102 (b)). The Act requires federal agencies to consider recommendations made by at-risk communities that have developed community wildfire protection plans (Sec. 101 (3)). An updated list of wildland urban 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 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 collaborated 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 18,000 acres from 2000-20010. 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 18,000 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 followed by Comstock-era logging, in addition to over 60 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.

Purpose and Need for Action

1. **Improve Defensible Space –**

   There is a need for defensible space adjacent to communities (on National Forest System lands) 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, Tahoe-Douglas 2004; Murphy and Knopp, eds. 2000a; USDA FS LTBMU 2004; TRPA 2007; USDA FS LTBMU 2007a).

2. **Reduce Risk of Catastrophic Wildfire –**

   There is a need to reduce tree density and surface fuel loading, because stands of trees have become overly dense and surface fuels have accumulated to such a degree that wildfires with sustained crown fire and long range spotting could quickly develop. This causes severe resource damage and threatens human life and property. Figure 3 provides an example of what this condition looks like.

3. **Improve Forest Health –**

   There is a need for restoration of forest health in the South Shore area where stands of trees have become overly dense, which subjects them to widespread forest dieback from insects and diseases. In addition, forest stands that are overly dense suffer stress from drought and competition for nutrients. (Murphy and Knopp, eds. 2000a; USDA FS LTBMU 2004; TRPA 2007; USDA FS LTBMU 2007a). Existing overcrowded stands have higher than average mortality which leads to ever-increasing fuel loads and high intensity wildfire risk.

4. **Improve SEZ Vegetation and Habitat –**

   There is a need for restoration of stream environment zones (SEZs), including aspen stands in the South Shore area, in order to reduce the potential for catastrophic wildfire to spread through these areas. There is also a need to promote maintenance of meadows and aspen stands consistent with the Forest Plan, in addition to the LTBMU and Pacific Southwest Research Station's "Aspen Community Mapping and Condition Assessment Report". There is also a need to provide habitat for wildlife and plant species that are dependent on SEZs and/or aspen (Shepperd et al 2006). The photo in Figure 4 is an example of aspen treatment and SEZ desired conditions for the South Shore project.

To meet the aforementioned needs for action, the proposed action would also be consistent with Forest Plan direction, desired conditions within the WUI and achieve the following purposes:

- Maintain or improve habitat conditions for threatened, endangered, and Forest Service sensitive species of plants and animals, consistent with the Forest Plan. Within the WUI defense zone, and strategic area treatments of the WUI threat zone, achieve management direction for the desired condition of forests that "are fairly open and dominated primarily by larger, fire tolerant trees" (SNFPA pg. 40, USDA FS 2004b, (Murphy and Knopp, eds. 2000a; USDA FS LTBMU 2004).

- Assure that treatments in SEZs promote the success of riparian species while providing for coarse woody debris recruitment and stream shading needs. (SNFPA pg. 64, USDA FS 2004b).
- Protect water quality consistent with the Forest Plan, the requirements of the Clean Water Act, and the Lake Tahoe Basin Plan.
- Reduce the risk for negative impacts to soil productivity and water quality from wildfire.
- Meet scenic quality objectives and stabilize scenic resources over the long-term by reducing the risk of impacts from wildfire and achieving the desired condition of stands that "are fairly open and dominated primarily by larger, fire tolerant trees." See Figure 5 for a before and after comparison of current and desired stand conditions.
- Meet air quality standards for the Lake Tahoe Basin by reducing the risk of impacts from wildfire.
- Discourage post-treatment establishment of user-created motorized or non-motorized routes or trails.
- Address public safety during implementation of the project.

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 three 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 revealed that there was uncertainty regarding the scope of effects from this project on the human environment largely due to the comparatively large area proposed for treatment. Therefore the responsible official elected to prepare a joint draft environmental impact statement/draft environmental impact report (DEIS/DEIR) in accordance with NEPA and CEQA.

Scoping for the DEIS/DEIR 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.

The Notice of Availability for the Draft EIS/EIR was published in the Federal Register and a legal notice was published in the Tahoe Daily Tribune on April 10, 2009. The 45-day comment period closed on May 26, 2009. Copies of the Draft EIS/EIR were mailed to the interested and affected public, as well as to required federal and state agencies on March 26, 2009.

Twenty comment letters were received. The response to comments is contained in Appendix E.

Issues

Scoping comments from the public, other agencies, and the Washoe Tribe of Nevada and California provided information used to define issues and formulate possible alternatives to the proposed action that responded to the issues. The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues are defined as concerns as to the effects that would be caused by implementing the proposed action that require additional alternative development to insure a reasoned decision can be made. 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, document E-2. Significant issues that were identified from the comments received during scoping on the proposed action are given below. These were used to frame alternatives.

Issue: Watershed Impacts

There was a concern whether implementation of the proposed action would result in adverse direct, indirect and/or cumulative effects to watershed conditions. Commenters expressed concern that the proposed action resulted in a risk to water quality and watershed condition due to the extent of the area and/or method of treatment in or near sensitive areas. There was particular concern about the cumulative effect of proposed activities in watersheds (HUC7) where the equivalent roaded acres (ERA) already exceed the threshold of concern (TOC).

How this issue was addressed:

An alternative to the proposed action was created (Alternative 3) which reduces the amount of total acres proposed for treatment. In addition, Alternative 3 proposes fewer acres of mechanical treatment methods shifting treatment to hand thinning. Proposed changes are primarily in sensitive areas (e.g stream environment zones). Changes in the amount and method of treatment resulted in corresponding changes in the follow up treatments such as the amount of prescribed burning. In response to the concern regarding the watersheds that already are over the TOC, Alternative 3 also redistributes the treatment acres proposed in each of these watersheds over all the years of the project as compared to the proposed action to reduce the maximum treatment acres in these watersheds in a given year, thereby reducing cumulative impacts.

Issue: Wildlife Areas

There was a concern that fuel reduction activities that reduce canopy closure would degrade California spotted owl and northern goshawk nesting and foraging habitat.

How this concern was addressed:

Alternative 3 responds to this concern by changing treatments based on evaluation of the following: spatial extent of northern goshawk and California spotted owl PACs, WUI zone (defense or threat), type of treatment proposed (mechanical or hand), stand survey data, and type of fire behavior predicted. Generally, the intensity of treatments proposed was reduced in PACs where models showed existing conditions were predicted to support only surface fires. There is one less PAC treated in Alternative 3.

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. Most of the South Shore project acres will require activities extending over a period of three to seven years after initial treatment 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 National Forest-owned urban lots within the urban core of the WUI, on National Forest lands within the ¼ mile WUI defense zone extending from the urban core, and on National Forest lands 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 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 Preferred Alternative is a modification of the Proposed Action. Vegetative treatments 10,112 acres would reduce hazardous fuels. This alternative was developed to address the issues raised in public scoping concerning watershed and wildlife effects. Alternative 3 provides an action alternative that reduces environmental effects to the extent practical while meeting the purpose for the project and concerns for public health and safety. Alternative 3 reduces impacts to watersheds and wildlife while meeting the purpose and need to effectively reduce fire risk in the WUI. In summary, environmental effects are reduced through a reduction in mechanical treatment units, a reduction in whole-tree mechanical units, an increase in cut-to-length units, an increase in hand thinning units, and an overall reduction in total project acres compared to Alternative 2.

Comparison of Alternatives

This section provides a comparison of the alternatives, based on the proposed activities in each alternative, of 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

Table ES-2. Comparison of Alternatives

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 pines. 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 (Preferred Alternative)	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.

Alternative Response to 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 overly 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 homes, 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 that are 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 table E-3; a discussion of the differences in environmental consequences for key resources follows.

Table ES-3. Fuel Treatment Methods by Alternative

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 alternatives. The following is a summary of the effects for these resource areas. The resource area effects discussed below are those raised by the public during scoping, or are resource areas with distinctive differences in effects between alternatives. This summary is not meant to capture all of the effects analyses for all resources. The detailed 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 mortality 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 remain 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, along with low resistance to drought, insects, or disease. The current trend for pine species to decrease would continue, with a corresponding increase in white fir and incense cedar, resulting in a forest 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. With removal of encroaching conifers, aspen stands currently at risk of loss from overtopping and competition from conifers would respond with new growth. 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 that 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 3 to 5 times greater than either action alternative 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 action alternative would cause any watershed to 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 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. Under the No Action alternative conifer stands within riparian conservation areas (RCAs) and SEZs will continue to remain dense with high fuel loads. Fire model simulations across the South Shore project area showed a distribution of low burn severity (4%), moderate severity (62%) and high severity (32%). It is assumed in case of wildfire under existing conditions that a portion of the potential high severity areas would be distributed in the RCAs/SEZs. Wildfire impacts could occur to riparian vegetation, which in-turn may affect stream channel stability if vegetation was no longer available to provide bank stability.

Both Alternative 2 and 3 would reduce conifer density in RCAs and SEZs adjacent to aquatic habitats which could reduce stream shading. Neither alternative is expected to reduce stream shading to an extent that would 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 upstream of the southern extent of activities in 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.

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. Public comments on wildlife effects of the Proposed Action were another factor in developing Alternative 3, along with comments about watershed effects. 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 where fire behavior modeling indicated a crown fire type were retained 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. Details and discussion of other species 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 areas, and aspen stands. Northern goshawk TRPA disturbance zones prescriptions would retain habitat components needed by goshawks while reducing surface and ladder fuels, and are also considered 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 some early- and mid-seral coniferous forest would change to late-seral open and closed canopy coniferous forest.

Vegetation management projects remove snags in green forests only when necessary to meet fuels reduction or safety objectives. On average, both action alternatives would retain a minimum of 3-8 medium to large snags per acre, per Forest Plan guidelines and project resource protection measures. 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 resource protection measures 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, as is the release of CO_2 and other greenhouse gases.

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 burning 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, and would release much less CO_2 and other greenhouse gasses.

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 dust. .

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.

The action alternatives would protect heritage and cultural resources through both passive and active methods. Passive methods are to flag and 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 activities 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 to VQOs. These areas would meet 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 meet the VQO of Retention or Partial Retention after 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 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 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 area 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 would 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, would alter the visual landscape and the experience of those recreating in these areas during and immediately 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, including two existing stream crossings that are currently blocking water flow and fish passage.

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 creation, 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 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 cleanup of slash and 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 by a larger factor than in Alternative 2. 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, extensive slash cleanup, and cleanup from past tree mortality. Alternative 3 would increase cut-to-length harvesting over whole tree harvesting compared to Alternative 2. Cut-to-length harvesting systems are more expensive than whole tree systems, and when combined with fewer total acres of mechanical harvesting in Alternative 3, 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 could be needed in twenty years where understory trees regenerate causing live fuel build up in the form of fire ladders. Maintenance treatments 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 during implementation. Based on a medium income of $70,516 for El Dorado County residents (US Census 2000, adjusted to 2006), the total employment-related income for Alternative 2 would be $1,762,900. During implementation, Alternative 3 would create an estimated 21 full time jobs for direct and induced employment. The total employment-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 disproportionately affect any minority or low income neighborhood. 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.

Monitoring Strategy

The purpose of project monitoring is to track the implementation of the resource protection measures found in Chapter 2 with the prescribed BMPs, and to measure their effectiveness in protecting resources. Monitoring is critical for evaluating the effectiveness of management decisions and the accuracy of analysis assumptions and conclusions. It is also important for a monitoring strategy to meet two essential criteria: (1) be helpful in making effective management decisions in the future, and (2) be feasible to implement.

Chapter 4 describes the monitoring that is required specific to the South Shore project. The description of monitoring is organized by resource. When a change in monitoring would be required by a difference between the action alternatives, a discussion of differences between alternatives is included. 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 project resource protection measures (termed "design features" in the DEIS) 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 resource protection measures 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

- *SEZ Pile Burning*
- *BMP and Resource Protection Measure Implementation*
- *BMP Evaluation Program*
- *Additional BMPEP Monitoring*
- *Forensic Monitoring*

Required Monitoring for Aquatic Resources

- *Stream Temperature and Shade*

Required Monitoring for Transportation

- *Storm Water Pollution Prevention Program*

Required Monitoring for Sensitive Plants and Fungi

- *NRIS Database*

Monitoring related to Invasive Weeds

- *NRIS Database*

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Chapter 1

Purpose and Need for Action

Document Structure

The Forest Service has prepared this Final Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA), and other relevant Federal laws and regulations. This Final EIS 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 a brief overview of the Forest Service proposal for achieving that purpose and need. This chapter also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives, including the Proposed Action

This chapter provides detailed descriptions of the no-action alternative (Alternative 1), and the two action alternatives the Forest Service considered for this project, the Proposed Action (Alternative 2) and the Preferred Alternative (Alternative 3). Chapter 2 includes the integrated design features/resource protection measures for each of the action alternatives. Finally, this chapter provides a summary table of the environmental consequences associated with each alternative (details are found in Chapter 3).

Chapter 3. Affected Environment and Environmental Consequences

This chapter describes the existing conditions of the land and resources within the project area and discloses the environmental effects of implementing each alternative, including the no action alternative. This chapter is organized by resource area.

Chapter 4. Monitoring

This chapter describes the monitoring that would take place under the action alternatives.

Chapter 5. Consultation and Coordination, Acronyms and Glossary, and References Cited

This section describes the coordination and consultation with Tribes and other Federal, State, and local agencies, provides aid to the reader for scientific and agency terms and acronyms, and details the literature references cited in the body of the EIS.

Appendices

The appendix sections of the FEIS provide additional information as needed to support the analyses presented in this EIS.

- Appendix A contains a summary of the past, present and foreseeable actions that were used in the cumulative effects analysis.

- Appendix B lists the best management practices (BMP's) applicable to this project.
- Appendix C outlines criteria used to evaluate the sensitivity of stream environment zones (SEZ's) within the project area.
- Appendix D displays the soil moisture protocol.
- Appendix E contains a list of all who commented on the DEIS, a consolidation of all comments (grouped by resource or interest area), and responses to each substantive comment.

Additional documentation may be found in the *project planning record* located at the U.S. Forest Service, Lake Tahoe Basin Management Unit, 35 College Drive, South Lake Tahoe, CA 96150. Inquiries related to the South Shore project planning record may be directed to the Forest Service, LTBMU, via email at: comments-pacificsouthwest-ltbmu@fs.fed.us, or by phone: (530)543-2600.

Background

Healthy Forest Restoration Act (HFRA) Process

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 (HFRA Sec.102 (b)). The Act requires federal agencies to consider recommendations made by at-risk communities that have developed community wildfire protection plans (HFRA 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 (CWPP's).

Coordination with these agencies in the development and use of their CWPP's is an important part of the HFRA analysis for this project. The community fire safe council worked with corresponding fire departments and fire protection district personnel to design these CWPP's for effective vegetation and fuels treatments and defensible space across all land ownerships, including National Forest System lands. The U.S. Forest Service, Lake Tahoe Basin Management Unit (LTBMU) collaborated with the fire districts and fire safe councils to design fuel reduction activities that are consistent with the CWPP's and provide the defensible space identified in the CWPP's where it occurs on National Forest System lands.

Land ownership patterns in the Lake Tahoe Basin present a challenge to project implementation. The CWPP's identify fuels treatment needs across multiple ownership jurisdictions (federal, state, local, and private). Approximately 65 percent of the CWPP treatments include National Forest lands. A successful fuels reduction program requires effective coordination among land management and regulatory agencies.

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 (HFRA 2003). Pursuant to HFRA, instead of an appeal period (36 CFR 215), there will be an "objection process" before the final decision is made and after the environmental document is available (36 CFR 218). In order to be eligible to file an objection to the preferred alternative, specific written comments related to the project must have been submitted during scoping or other public involvement opportunities on this EIS (36 CFR 218.6). Individual members of organizations must have submitted their own comments to meet the requirements of eligibility as an individual, objections received on behalf of an organization are considered as those of the organization only.

Emphasis on Reducing Conifer Density and Treating Fuels

The 2007 Angora Fire, started on National Forest System lands (NFS), burning approximately 3,100 acres and destroying or damaging more than 250 structures. This fire was a devastating fire to many people who live in the neighborhoods within the South Shore of Lake Tahoe. Lessons learned from the Angora Fire concluded that where fuels and vegetation treatments were completed prior to the fire, they worked as intended, by reducing fire intensity from a crown fire to surface fire, reducing ember spotting distances (to <50 feet), and ultimately increasing firefighters ability to take safe and "close-in" suppression actions, thus minimizing the overall potential fire damage to structures. In areas that were untreated, such as slopes and the Angora Creek Stream Environment Zone (SEZ), the fire burned as a crown fire consuming 95-100 percent of the tree crowns and surface vegetation, it created ember spotting distances as far as ½ mile, and suppression resources could not safely engage the fire due to rapid rates of spread and very high intensity caused by continuous dense stands of trees and high surface fuel loading (Murphy et al 2007). Ultimately, the areas that had prior vegetation/fuels treatments are currently in a healthier forest condition that is resilient to fire where intact stands of trees exist with lower surface fuel loads, and a diversity of surface vegetation and snags.

The LTBMU, State, and local agencies have conducted thinning and fuels reduction efforts on approximately 30,000 acres within the Lake Tahoe Basin from 2000-2010. In 2007, the Tahoe Regional Planning Agency (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 emphasizes the need for increased efforts in treating fuels and forest thinning 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 conifer density and hazardous fuel loads in the Lake Tahoe Basin. The Lake Tahoe Watershed Assessment (Murphy & Knopp, editors 2000a) found that current tree density is approximately four times that of 150 years ago. They also found a pronounced shift in the species composition of younger trees away from pine and towards fir. 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. The Watershed Assessment reported 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 among the shortest in the Sierra Nevada. It was also noted that the Lake Tahoe Basin has one of the highest fire ignition rates in the Sierra Nevada, concentrated around the urban interface. The Lake Tahoe 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 2000a, pg. 15). The Watershed Assessment recommended “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 2000a, 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).

The LTBMU Stewardship and Fireshed Assessment used Basin-wide fire modeling to evaluate the likely effects of unplanned fires on urban areas. The Fireshed Assessment found that the most severe fires, and therefore effects, would occur in lower elevation pine and mixed conifer forests (USDA FS 2007a). 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 loss of recreational opportunities and tourism (TRPA 2007, Executive Summary, pg. E-1). The wildfire behavior modeled and predicted (within 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 the South Shore project) was initiated in response to public wildfire risk concerns and the existing hazardous fuel conditions. The 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 CWPP's of communities in the South Shore area. Collaborative efforts with 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 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 the initial efforts in collaboration.

Purpose and Need for Action

The following needs have been identified in this project area:

1. **Improve Defensible Space –** There is a need for defensible space adjacent to communities (on National Forest System lands) 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, Tahoe-Douglas 2004; Murphy and Knopp, eds. 2000a; USDA FS LTBMU 2004; TRPA 2007; USDA FS LTBMU 2007a).

Figure 2. Forest Service sign within an urban lot. Photo depicts project treatments in proximity to homes and neighborhood in the Wildland Urban Interface. Located within the Bijou neighborhood, South Lake Tahoe.

2. **Reduce Risk of Catastrophic Wildfire –** There is a need to reduce tree density and surface fuel loading, because stands of trees have become overly dense and surface fuels have accumulated to such a degree that wildfires with sustained crown fire and long range spotting could quickly develop. This causes severe resource damage and threatens human life and property. Figure 3 provides an example of what this condition looks like.

Figure 3. Current fuel loading example within the South Shore project area, woody debris greater than 40 tons/acre. Location: Off Hwy 50 at Upper Truckee River.

3. **Improve Forest Health –** There is a need for restoration of forest health in the South Shore area where stands of trees have become overly dense, which subjects them to widespread forest dieback from insects and diseases. In addition, forest stands that are overly dense suffer stress from drought and competition for nutrients. (Murphy and Knopp, eds. 2000a; USDA FS LTBMU 2004; TRPA 2007; USDA FS LTBMU 2007a). Existing overcrowded stands have higher than average mortality which leads to ever-increasing fuel loads and high intensity wildfire risk.

4. **Improve SEZ Vegetation and Habitat –** There is a need for restoration of stream environment zones (SEZs), including aspen stands in the South Shore area, in order to reduce the potential for catastrophic wildfire to spread through these areas. There is also a need to promote maintenance of meadows and aspen stands consistent with the Forest Plan, in addition to the LTBMU and Pacific Southwest Research Station's "Aspen Community Mapping and Condition Assessment Report". There is also a need to provide habitat for wildlife and plant species that are dependent on SEZs and/or aspen (Shepperd et al 2006). The photo in Figure 4 is an example of aspen treatment and SEZ desired conditions for the South Shore project.

Figure 4. Desired condition within a Stream Environment Zone (SEZ) of a meadow with an Aspen Stand. Location: Heavenly SEZ Demonstration Project, Pioneer Trail at Al Tahoe Blvd.

To meet the aforementioned needs for action, the proposed action would also be consistent with Forest Plan direction, desired conditions within the WUI and achieve the following purposes:

- Maintain or improve habitat conditions for threatened, endangered, and Forest Service sensitive species of plants and animals, consistent with the Forest Plan. Within the WUI defense zone, and strategic area treatments of the WUI threat zone, achieve management direction for the desired condition of forests that "are fairly open and dominated primarily by larger, fire tolerant trees" (SNFPA pg. 40, USDA FS 2004b, (Murphy and Knopp, eds. 2000a; USDA FS LTBMU 2004).
- Assure that treatments in SEZs promote the success of riparian species while providing for coarse woody debris recruitment and stream shading needs. (SNFPA pg. 64, USDA FS 2004b).

- Protect water quality consistent with the Forest Plan, the requirements of the Clean Water Act, and the Lake Tahoe Basin Plan.
- Reduce the risk for negative impacts to soil productivity and water quality from wildfire.
- Meet scenic quality objectives and stabilize scenic resources over the long-term by reducing the risk of impacts from wildfire and achieving the desired condition of stands that “are fairly open and dominated primarily by larger, fire tolerant trees.” See Figure 5 for a before and after comparison of current and desired stand conditions.
- Meet air quality standards for the Lake Tahoe Basin by reducing the risk of impacts from wildfire.
- Discourage post-treatment establishment of user-created motorized or non-motorized routes or trails.
- Address public safety during implementation of the project.

Figure 5. Examples of current (left) and desired condition (center and right) conifer stand comparison – before and after treatment. Location: Heavenly SEZ Demonstration Project (Al Tahoe Blvd at Pioneer Trail, South Lake Tahoe). Middle photo was taken immediately following treatment; Photo at right illustrates vegetation conditions 4 years after treatment.

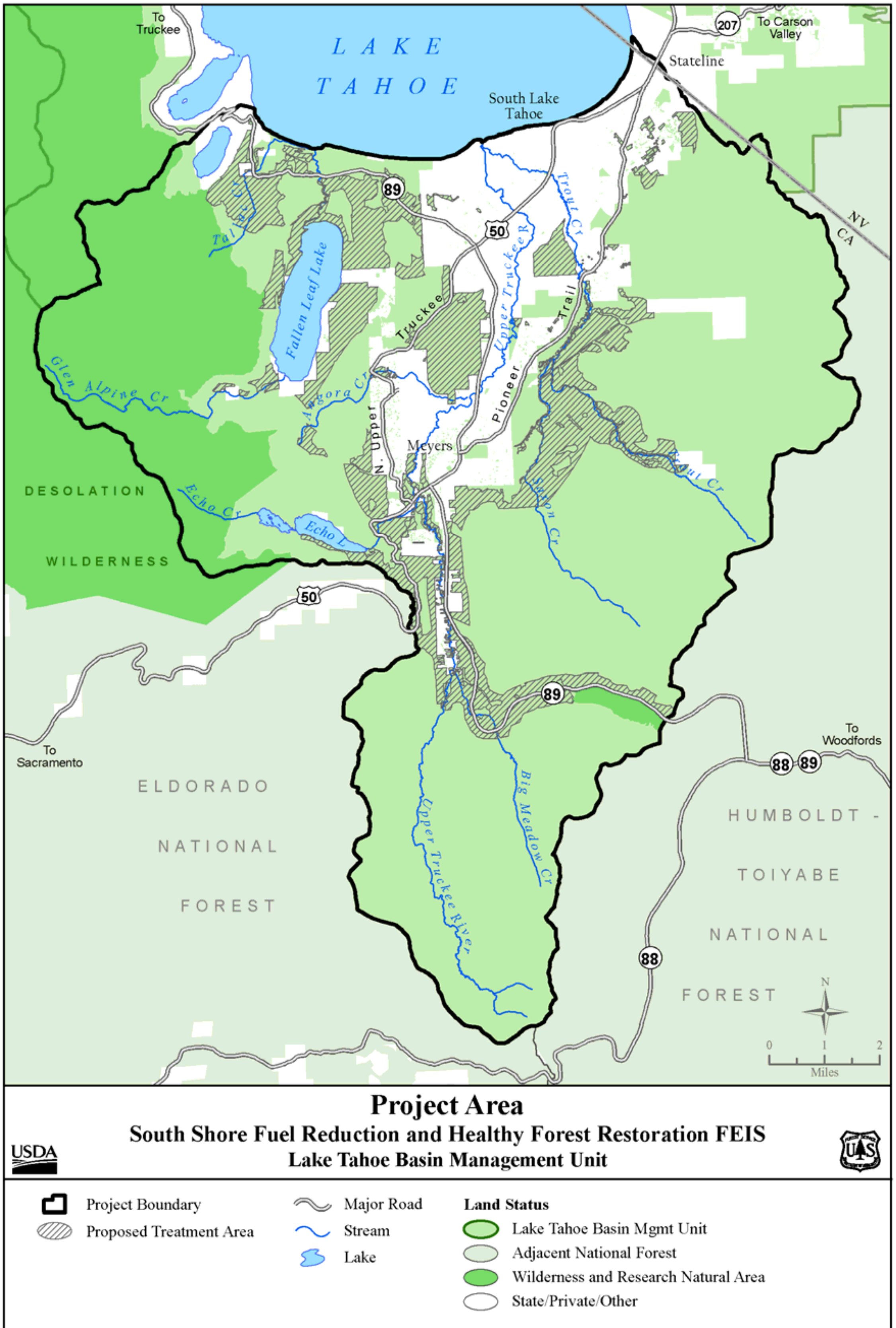

Figure 6. South Shore Project Area Map

Proposed Action

The Forest Service proposes vegetation treatments on 10,670 acres to reduce hazardous fuels, improve forest health and restore aspen stands within the South Shore Project Area. Fuel reduction would occur in all three zones of the Wildland Urban Interface (WUI): 1) On Forest Service owned urban lots within the WUI urban core, and 2) on Forest Service lands within the WUI Defense and, 3) WUI Threat Zones. The Defense Zone generally extends ¼ mile from the private land / Forest Service boundary and the Threat Zone extends approximately 1¼ miles beyond the Defense Zone. Consistent with SNFPA (USDA FS 2004, ROD p. 40), in the project area, the WUI boundaries were refined based upon site-specific topography and other features that provide logical fireline placement during suppression, such as slope breaks, roads, and streams (See Map 5).

Trees would be removed using a combination of mechanical and hand thinning methods. Mechanical methods would include using tracked and rubber-tired equipment designed to remove and process trees and vegetation. Residual fuels left following tree removal would be treated by a combination of prescribed burning, mechanical treatment (e.g. chipping and mastication) and/or removal. The proposed action also includes road crossing reconstruction at three locations. Implementation would be scheduled to start in 2011 and take approximately eight years to complete all the treatments proposed.

A detailed description of the proposed action (Alternative 2) is presented in Chapter 2.

Figure 7. Prescribed (Rx) fire follow up operation – pile burning

Decision Framework

Decision to be Made

The Responsible Official (36 CFR 218.2) is Nancy J. Gibson, Forest Supervisor, Lake Tahoe Basin Management Unit, 35 College Drive, South Lake Tahoe, CA 96150. The Forest Supervisor will review the proposed action, the other alternatives, public, agency and tribal input, and the environmental consequences in order to decide whether to:

- Implement the proposed action (Alternative 2) as described in Chapter 2
- Implement the preferred alternative (Alternative 3) as described in Chapter 2
- Implement a decision that combines a mixture elements from either Alterative 2 or 3
- Take no action at this time

The decision will be published in a Record of Decision signed by the Forest Supervisor at the conclusion of a 30 day objection period in accordance with HFRA (36 CFR 218.12).

Scope of the Decision

The scope of the decision would apply only to National Forest System lands within the South Shore project area managed by the LTBMU. This decision is within the authority delegated to the Forest Supervisor as the Responsible Official. There are no areas within designated Wilderness or Research Natural Areas proposed for treatment. Therefore approval by the Regional Forester or Station Director, respectively, is not required.

Approximately 650 acres of area considered for fuel reduction treatment are included where the WUI overlaps Inventoried Roadless Areas (IRAs) in the project area. Management of IRA's on National Forest System lands is currently the subject of conflicting Federal Court decisions. On November 5, 2009, Regional Forester Randy Moore issued a letter outlining Roadless Area Management Direction for the Pacific Southwest Region (R5) based on delegations made by the U.S. Secretary of Agriculture to the Forest Service. Based on R5 direction the South Shore project is within a class of action that requires review by the Regional Office and notification to the State of California. The State of California has not filed a petition for these IRAs under the 2003 Roadless Rule.

Revisions from DEIS/DEIR to FEIS

This FEIS complies with the National Environmental Policy Act (NEPA). Since this project was initially conceived in 2006 there have been significant events that have influenced the creation of the final document. Notably the Angora Fire (June 2007) and the subsequent recommendations made in the California-Nevada Tahoe Basin Fire Commission report issued in May 2008.

The LTBMU and Lahontan Water Board originally produced a joint Draft EIS/EIR, released in April 2009. The DEIS was compliant with NEPA and the DEIR was compliant with the California Environmental Quality Act (CEQA). At the outset of the analysis there was concern that a project of this size may have significant environmental consequences. This uncertainty lead to the decision by the Forest Supervisor and the Lahontan Water Board that a joint DEIS/DEIR would be appropriate should the analysis find the project would have significant impacts. The subsequent detailed analysis as presented in the DEIS concluded that there are no significant impacts that would result in the implementation of either of the action alternatives. Comments on the DEIS did not uncover any issues that would lead to the conclusion that the proposed action alternatives, as described with the associated extensive resource protection measures (mitigations), would not result in significant impacts. The FEIS continues to make the finding that either of the action alternatives will not result in significant impacts. Therefore, without significant impacts further development of an EIR (under CEQA) or EIS (under TRPA) is not warranted. Since the Forest Service started with an EIS it will continue under those NEPA regulations rather than issue an Environmental Assessment, Decision Notice and Finding of No Significant Impact.

Based on a July 2011 court decision, the MOU between the TRPA and the Lahontan Water Board allowing single agency permitting for vegetation management projects is no longer valid. Consequently the Forest Service will seek the appropriate permits from both the TRPA and the Lahontan Water Board based on their respective authorities and, in the case of the TRPA, the vegetation management MOU that remains in place. This FEIS will be the basis for any environmental documentation.

Public Involvement

The initial 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, 2007. Field trips to a series of three sites for an on-the-ground look at types of areas proposed for fuel treatments by the South Shore project were hosted by members of the interdisciplinary team on Tuesday, August 21, 2007, and Saturday, August 25, 2007, from 10 am to 2 pm. An evening open house on August 23, 2007, also provided the public an opportunity to ask questions and gather information about this project. Over 75 people visited the field sites, and seven people attended the open house. A total of seven written comment letters were received.

As a result of this initial scoping and during the preliminary environmental analysis phase there were public and other agency concerns due to the complexity of the proposal over such a large project area. Since it was uncertain if a Finding of No Significant Effect could be made the Forest Supervisor decided to prepare an environmental impact statement and forego an environmental assessment. After a number of collaborative meetings with the TRPA and Lahontan Water Board, the Forest Supervisor in cooperation with Executive Director (Lahontan Water Board) elected to prepare a joint draft environmental impact statement/draft environmental impact report (DEIS/DEIR) in accordance with NEPA and CEQA.

Scoping was done in accordance with 40 Code of Federal Regulations (CFR) part 1501.7 – Scoping. The Notice of Intent (NOI) 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 NOI was published in the Federal Register.

The 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 additional letter was received in response to this scoping effort.

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 were retained and treated the same as those received subsequent to the publication of the notice of intent and notice of proposal.

The Notice of Availability for the Draft EIS/EIR was published in the Federal Register and a legal notice was published in the Tahoe Daily Tribune on April 10, 2009. The 45-day comment period closed on May 26, 2009. Copies of the Draft EIS/EIR were mailed to the interested and affected public, as well as to required federal and state agencies on March 26, 2009. Copies of the Draft EIS/EIR were posted at the El Dorado County Clerk's office, the South Lake Tahoe public library, and at the LTBMU Forest Supervisor's office and visitor's centers. A total of 20 letters of comment were received on the Draft EIS/EIR; one from the Washoe Tribe of Nevada and California, three from government agencies, two from fire protection organizations, seven from environmental groups, and seven letters from individuals. All comments from these letters were sorted, grouped by subject, and analyzed. The Response to Comments is found in Appendix E of this FEIS document.

Issues

Scoping comments from the public, other agencies, and the Washoe Tribe of Nevada and California provided information used to define issues and formulate possible alternatives to the proposed action that responded to the issues. The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues are defined as concerns as to the effects that would be caused by implementing the proposed action that require additional alternative development to insure a reasoned decision can be made. 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, document E-2. Significant issues that were identified from the comments received during scoping on the proposed action are given below. These were used to frame alternatives.

Issue: Watershed Impacts

There was a concern whether implementation of the proposed action would result in adverse direct, indirect and/or cumulative effects to watershed conditions. Commenters expressed concern that the proposed action resulted in a risk to water quality and watershed condition due to the extent of the area and/or method of treatment in or near sensitive areas. There was particular concern about the cumulative effect of proposed activities in watersheds (HUC7) where the equivalent roaded acres (ERA) already exceed the threshold of concern (TOC).

How this concern was addressed:

An alternative to the proposed action was created (Alternative 3) which reduces the amount of total acres proposed for treatment. In addition, Alternative 3 proposes fewer acres of mechanical treatment methods shifting treatment to hand thinning. Proposed changes are primarily in sensitive areas (e.g stream environment zones). Changes in the amount and method of treatment resulted in corresponding changes in the follow up treatments such as the amount of prescribed burning. In response to the concern regarding the watersheds that already are over the TOC, Alternative 3 also redistributes the treatment acres proposed in each of these watersheds over all the years of the project as compared to the proposed action to reduce the maximum treatment acres in these watersheds in a given year, thereby reducing cumulative impacts.

Issue: Wildlife Areas

There was a concern that fuel reduction activities that reduce canopy closure would degrade California spotted owl and northern goshawk nesting and foraging habitat.

How this concern was addressed:

Alternative 3 responds to this concern by changing treatments based on evaluation of the following: spatial extent of northern goshawk and California spotted owl PACs, WUI zone (defense or threat), type of treatment proposed (mechanical or hand), stand survey data, and type of fire behavior predicted. Generally, the intensity of treatments proposed was reduced in PACs where models showed existing conditions were predicted to support only surface fires. There is one less PAC treated in Alternative 3.

Forest Plan Consistency

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. Acres of Ownership in Project Analysis Area

Ownership	Acres
Private Ownership	8,088
Other (State, County)	8,121
National Forest System lands	70,581
Total Project area, all ownerships	**86,790**

The proposed action and alternatives are guided by the LTBMU Land and Resource Management Plan (Forest Plan or LRMP) (USFS LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (SNFPA, USDA FS 2004b) and other amendments.

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. The analysis for consistency with the Forest Plan is contained in the project planning record. The analysis for consistency with the Riparian Conservation Objectives (RCO) described in the SNFPA is contained in the RCO Analysis Report (PR# J14).

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)

The following documents provide 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 FS, 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 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 LTBMU 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, and landings, at a frequency that would control dust.

Environmental Justice (Executive Order 12898)

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 (USFWS) 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. Informal consultation was completed for the South Shore project because Lahontan cutthroat trout, a Threatened species, or their associated habitat, could potentially be affected by this project (see Chapter 3, Aquatic Wildlife).

A discussion also occurred concerning whether technical assistance should be requested for the Candidate species mountain yellow-legged frog. Both FWS and the LTBMU agreed that although mountain yellow-legged frog habitat may exist within the project analysis area, recent amphibian surveys support that the species does not occur within the project treatment area; therefore technical assistance would not be required.

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, and are addressed in the terrestrial wildlife sections of Chapter 3.

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. As stated above, the South Shore project complies with the LRMP.

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).

United States District Court, Eastern District of California Ruling – 11/4/09

On November 4, 2009 Judge Morrison C. England issued a Memorandum and Order requiring that fuels projects that are under the 2004 Sierra Nevada Forest Plan Amendment and were not approved prior to November 4, 2009 must include a detailed consideration of a noncommercial funding alternative. The South Shore Project is compliant with this order because both of the action alternatives (Alternative 2 and 3) represent noncommercial funding alternatives as described in the Court Order. Implementation of either alternative is not based, nor depends on, the commercial sale of wood fiber (e.g., saw timber, fuelwood and/or biomass). The prescriptions for tree removal and vegetation management are based solely on fuels and forest health objectives as described in Chapter 2 and not on any value in the products removed. It is not an objective of the South Shore Project to generate revenue (Chapter 1, Purpose and Need). It is anticipated that most of the funding for implementation will come from sources such as the Sierra Nevada Public Lands Management Act. However, this does not mean that wood fiber products will not be sold as a spin-off of project operations. Should markets exist at the time of implementation for wood fiber products, the Forest Service may elect to dispose of project generated fuels via sale to meet the ecological goals of the project. The potential revenues are displayed in Chapter 3, Economic Conditions and Effects.

Permits and Coordination

The Forest Service is 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. This includes coordination with Federal, County, and State of California regulatory agencies, including air quality management districts and water quality control boards.

El Dorado Air Quality Management District

Permits would be required from the El Dorado Air Quality Management District prior to prescribed burning.

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

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.

Based on the analysis presented in the FEIS, the South Shore Project meets the above criteria, and is eligible for enrollment in the 2009 Timber Waiver from Lahontan Water Board. Since this project will take several years to complete, the Forest Service will apply for enrollment under the 2009 Timber Waiver (or any successor waiver) and/or for permits prior to on-the-ground operations. The Lahontan Water Board would complete appropriate additional CEQA documentation required for any phase they find not eligible for the 2009 Timber Waiver. This adaptive approach will ensure that any necessary permitting is streamlined and contemporary with project operations.

Tahoe Regional Planning Agency (TRPA)

Since January 2009 the TRPA and the Lahontan Water Board have had a MOU that allowed one of the agencies to be the singular regulating agency. This was in compliance with the recommendations of the 2008 California-Nevada Tahoe Basin Fire Commission for streamlining the permitting process. Under this MOU the Lahontan Water Board was designated as the permitting agency for the South Shore project. However in July 2011 the MOU between these agencies was found to be invalid by a state court, consequently the project will also need TRPA review. The TRPA and Forest Service, LTBMU have a MOU for vegetation management projects. The provisions of this MOU will apply to the South Shore project.

Chapter 2

Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the South Shore Project. It describes the three 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 consequences can be readily compared.

Revisions of Chapter 2 for the FEIS

Based on detailed review and comments received on the draft environmental impact statement (DEIS), Chapter 2 has been entirely reorganized for the final environmental impact statement (FEIS); however the changes are in presentation and format only. Much of the information has been consolidated into tables for clarity. There is no substantive change in the project actions as proposed on the ground in any of the alternatives from what was presented in the DEIS. The revised presentation reformatted acreages to be more consistent and comparable between the alternatives and for improved consistency for resource analysis, but they are based on the same treatment units and prescriptions that were the foundation for the DEIS. Definitions for all the activities were revised and expanded to provide greater clarity, but they describe the activities as proposed in the DEIS and do not represent any changes to the methods that are proposed. Some treatment prescriptions that appeared to be separate activities in the DEIS, but were really overlapping have been revised. For example, meadows and SEZ treatments were differentiated in the DEIS, but in the FEIS they are combined because the treatment prescription is the same.

Overall the chapter has been streamlined to first present comprehensive descriptions of the actions proposed in the alternatives followed by the resource protection measures (formerly called design features) that would apply to both of the action alternatives (Alternatives 2 and 3). The background information that was presented in the DEIS Chapter 2 has been moved to Chapter 3 under each resource area. The resource protection measures have been collated into a tabular format by general resource area. Resource protection measures were edited to remove duplication and clarify the objective and intent of the measure. The source reference for each resource protection measure had been added. Appendix C which listed both BMPs and a replication of soil and water related resource protection measures (design features) has been streamlined to include only applicable BMPs from the FS Region 5 BMP handbook. All of the resource protection measures are now included in one place in this chapter.

The analysis of comments on the DEIS (Appendix E) did not lead to the formation of any new alternatives considered in detail. However they did result in some additional information to clarify the alternatives that were considered but eliminated from detailed study (which begins on p. 2-49).

Alternatives Considered in Detail

Three alternatives are considered in detail:

- Alternative 1: No Action
- Alternative 2: Proposed Action
- Alternative 3: Preferred Alternative

Alternative 1 – No Action

Under the No Action alternative, the South Shore project would not be implemented. There would be no landscape level treatment of vegetation and fuels on National Forest System lands in the wildland urban interface (WUI) within the analysis 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 as described in the action alternatives. The current conditions of dense stands and high fuel loads would continue to decrease forest health conditions and fire suppression capabilities within the project area.

However, there would be fuel reduction and forest health restoration activities ongoing within the project area under previously approved vegetation management activities. These activities include management of vegetation and fuels on Forest Service urban lots outside of SEZs, restoration of some aspen stands through the Aspen Community Restoration Project, vegetation and fuels treatments in the Big Meadow Creek Watershed Fire Regime Restoration Project, and fuels treatments in the High Meadow Restoration Project. In addition the Angora Fire Restoration Project which includes five major restoration activities: fire and fuels, vegetation and forest health, wildlife habitat, aquatic habitat and stream channel restoration, road and trail delineation and noxious weed detection and removal within the Angora Fire area was approved on July 9, 2010.

No Forest Service System road maintenance activities associated with vegetation and fuels management would occur and only the routine annual road maintenance would continue. Ongoing vegetation management activities would use the existing road system. The three road crossings proposed for reconstruction in the action alternatives would be deferred or not constructed.

Alternative 2 – Proposed Action

This alternative was designed to meet the purpose and need identified in Chapter 1, by:

- Creating defensible space,
- Restoring forest health and resiliency, and
- Restoring SEZs and aspen stands.

It represents the initial proposed action presented during the scoping period. Prescriptions were further refined as a result of scoping for the DEIS. No changes in prescriptions were made in this alternative between the DEIS and FEIS.

In Alternative 2 the Forest Service proposes to treat 320 units totaling approximately 10,670 acres within the 70,581 acres of National Forest System land in the South Shore Project analysis area.

Vegetation Treatment

Initially vegetation (trees and brush) would be thinned using one of the following methods:

- **Mechanical thinning** using:

  - **Whole-tree (WT)** – Whole tree harvesting thins stands by felling and bunching cut trees and larger surface fuels and then skidding the material to a landing. When processed at the landing, the limbs and tops are either chipped for biomass removal or piled to be burned later. Logs are loaded onto trucks for removal.
  - **Cut-to-length (CTL) -** A CTL harvester simultaneously thins stands, processing logs and bunching biomass for removal while traveling over a portion of the limbs and tops from the trees harvested. A forwarder self-loads logs with or without branches for transport to a landing as well as biomass that will be removed from the project area usually in the form of chip. Logs are generally not skidded. A chipper at the landing usually processes material into clean chip for manufacturing into oriented stand boards and biomass utilization.
- **Hand thinning (HT) -** This method involves hand crews using chainsaws to buck and pile surface fuels, cut and pile small diameter fuel ladders, and thin canopy trees (living and dead) up to approximately 20” diameter.

Table 2-1. Summary of Thinning Method Acres Proposed in Alternative 2

	Mechanical Thinning		Hand Thinning	Total
	WT	CTL		
Upland	3620	1463	4855	9938
SEZ	198[1]	447	87	732[2]
Method Subtotal	3818	1910	4942	10670
Total	5728			

Notes:
[1] Estimate of SEZ inclusions within WT units. These areas would be treated by endlining.
[2] Includes 290 acres of aspen and meadow treatments.

Implementation Schedule Limitations

An important element to Alternative 2 is how the implementation of the thinning treatments would be spread over time within each of the watersheds. This distribution ensures only a limited number of acres would be treated within a watershed in any given year. This treatment design provides only a maximum limit on thinning activities. There is no minimum limit, as weather, contractor availability, or other unforeseen factors may dictate a slower pace than the maximum possible. It is anticipated that the South Shore Project could take as long as eight years to complete, depending on factors such as funding, weather, operating season and burning conditions. The distribution of treatments across watersheds in the project is analyzed in Chapter 3, Water and Riparian Resources section.

Follow-up Treatments

After vegetation is thinned, follow up treatments to reduce or redistribute residual fuel that was created by thinning, or present prior to thinning, would include the following methods:

- **Lop and Scatter** – A hand method of reducing the upward extending branches from tops and limbs of felled trees to keep slash low to the ground (generally 12" to 18") and spread out. Material is left or may be a pre-treatment to underburning.
- **Mastication/Chipping** – Uses a variety of rotary or drum cutters that grind and spread remaining surface fuels disconnecting them from the tree canopy. In some areas where access is appropriate chipped material may be removed from the site.
- **Prescribed Fire**
    - **Pile & burn –** Slash created by thinning treatments and existing dead woody debris are stacked in piles with the intent of burning when conditions in an approved burn plan are met, usually two to three years later. Piles are generally distributed throughout a treatment unit. Piles are most often created by hand crews but may be constructed in CTL units by using a grappler attachment to a forwarder (Grapple pile).
        - During pile burning fire is not confined to the pile. Fire is allowed to move through the unit to consume surface fuels that have not been piled.
        - Pile burning is normally conducted as opposed to underburning as an initial fuels treatment due to the high accumulations of fuels generated by thinning.
    - **Underburning** – Also termed broadcast burning, refers to burning residual fuels in place when conditions in an approved burn plan are met.
    - **Landing pile burning** – Woody material that remains on landings is typically machine piled and burned when conditions in approved burn plan are met.

Table 2-2. Estimated Follow-up Treatments Proposed in Alternative 2

Follow up Treatment Method	Associated Thinning Method	Upland Acres	SEZ Acres	Total Acres
Lop & Scatter	WT, CTL, HT	2353	198	2551
Mastication/Chipping	WT, CTL, HT	2480	0	2480
Underburning (lop and scatter)	WT, CTL, HT	850	32	882
Pile & burn	HT	4372	87	4459
Grapple Pile & Burn	CTL	515	0	515
Landings – pile burning and/or removal	WT	128	0	128
Note: In some cases follow up treatment methods may overlap, for example some units may be partially treated by hand piling and also underburned. As a result the acreages shown in Table 2-2 are not additive.				

Follow up residual fuel treatments are prescribed based on the conditions within an individual treatment unit after thinning has been completed. The type of thinning treatment, amount of surface and activity fuels, stand location and topography, air quality, treatment cost, and species composition, were all considered when determining the follow-up treatment. The prescriptions are designed separately from the thinning method to meet fuels treatment objectives and desired conditions, and are therefore not necessarily connected to the thinning method used. The residual fuels are a combination of existing fuel prior to treatment and the fuels generated by the treatment.

The acreage estimates presented in Table 2-2, above, are based on expected fuel loading and conditions after thinning operations. The prescriptions take into account the pre-treatment fuel load and predicted residual fuel post thinning as well as soils, slope, location, remaining vegetation etc. The acreages may change when implemented based on the actual outcome of the thinning and pre-project ground conditions.

While removal of woody biomass would be preferred to burning whenever feasible, there is no way to predict what the biomass market will be at the time this project is implemented. Consequently this analysis assumes all follow up treatments will involve whole tree removal or treating the residual fuels on site in the absence of a market that can utilize the materials.

Roads and Access

Landings – An estimated 219 landings could be used to support the proposed thinning activities proposed in Alternative 2. Approximately 177 of these landings would be constructed on previously used landing sites. Landings would average less than one acre but would not be larger than two acres. Generally landings used for WT operations tend to be larger than CTL operations. Existing vegetation would be removed from the landing site and piled for later burning.

System Road Management – Alternative 2 would use 26.7 miles of existing System roads. Of the System roads used, 11.7 miles would receive maintenance activities which generally include minor drainage maintenance, surface repair, and brushing. The remaining 15 miles would need reconstruction. Reconstruction includes maintenance activities plus activities such as, replacement of inadequate drainage crossings, elimination of ruts, ditch repair, and installation of waterbars and dips to provide adequate runoff. Roads proposed for reconstruction are either Maintenance Level 1 or 2. At the conclusion of the project all FS System roads would be left in a condition consistent with the assigned Maintenance Level as prescribed by the Forest Development Road Plan.

Temporary Roads – Alternative 2 would propose to construct 13.6 miles of temporary road. Of the total mileage proposed, 8.8 miles is on old existing road prisms and only 4.8 miles requires new construction.

Temporary road construction involves the following activities:

- **Vegetation removal:** Light brush, small trees, and grasses would usually be removed by equipment such as dozers or graders. Larger trees and brush would require hand removal and piling for disposal. Clearance limits would generally allow one-way passage for equipment and trucks, but would not be cleared beyond the original road prism when one exists. In general, temporary roads would not have constructed turnouts to accommodate two-way traffic. Traffic control measures such as radio communications would be utilized
- **Grading:** For new temporary roads, the road prism would be graded by equipment. Generally, the road would be outsloped to ensure that effective drainage is maintained. For temporary roads that follow existing old road prisms, obstacles such as ruts, water bars, leadoff ditches, and pronounced dips would be graded out to make the road suitable for equipment and truck traffic.
- **Drainage:** Facilities such as culverts or fords would be installed to accommodate the free flow of drainages and ditches. Dips and leadoff ditches, with energy dissipaters as needed, would be installed to facilitate occasional thunderstorm runoff. If vegetation at the end of leadoff ditches

and dips is not sufficient to disperse sediment loads, rock or slash would be placed to adequately disperse sediment loads.

Temporary road stream crossings would be needed in 28 locations on ephemeral channels, and one temporary crossing on an intermittent channel. The number of stream crossings and the type of stream channel that would be crossed are given for each 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

Temporary roads would be constructed, used then decommissioned at the conclusion of use. Temporary stream crossings would be constructed, used then decommissioned within one season, except the Saxon Creek intermittent crossing. No temporary roads are proposed for inclusion into the FS System. Decommissioning would use a variety of actions but would leave the road impassible to vehicles, and hydrologically stable (see resource protection measures).

Crossing and Culvert Replacement - Alternative 2 proposes the replacement of three existing permanent stream crossings that are currently acting as fish passage barriers, sediment conveyance barriers, and/or sediment sources. One of these is on an intermittent channel in the Lower Trout Creek watershed (12N01A), one is on an ephemeral channel in the Cold Creek watershed (12N08), and one is on a perennial channel in the Osgood Swamp watershed (12N20).

Forest Service System Road 12N01A

The existing crossing on Forest Service System road 12N01A over an intermittent tributary to Saxon Creek in the Lower Trout Creek watershed is acting as a flood passage barrier, is causing erosion immediately downstream, and has caused aggradation upstream. This crossing replacement also reduces the need for temporary roads by 0.7 mile. The replacement crossing design would meet the following specifications:

- 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. 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, it would be pumped to adjacent upland areas.

- The crossing would be designed to support the weight of the crossing and its intended use by thinning and fire suppression equipment.
- 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 meeting Forest Service specifications to support the weight of the crossing and the intended use (BMP 2-17).
- The proposed design for the new channel crossing is for multiple arched culverts spanning the entire width of the floodplain. The culvert in the center of the crossing (where a channel has formed downstream of the road) would be the largest, and is designed to pass the bankfull flow volume. Surrounding the culverts would be gabion baskets filled with small boulders, which would also be permeable to water flow. 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 granular material that would no longer restrict flood flows across and through the road. Other designs, such as a series of pre-fabricated bridge segments with gabion basket supports filled with small boulders permeable to water flow may be considered if they meet the criteria above and would reduce impacts to the SEZ.

Powerline Road (12N08)

The ephemeral channel crossing replacement in the Cold Creek watershed is along Powerline Road (12N08). The existing crossing consists of a 24" round culvert with cement bag headwalls and side walls, and presents a problem for access by equipment needed for South Shore treatments. The road fill over the crossing is minimal, less than 2 ft. The current crossing entry slope is approximately 15% grade coming from the south and the exit slope is about 20% grade. These slopes are too steep for haul trucks to access the treatment areas beyond this crossing. The new culvert crossing would consist of a 48" corrugated metal culvert and approximately 5 ft. of fill to bring the road grade at the crossing to an acceptable height for haul trucks to pass the entry and exit slopes. This fill would be excavated primarily from the road alignment on either side of the crossing, with some excavation coming from the land adjacent to the road to lessen the slopes on either side of the road prism. In order to reduce the amount of fill needed for this culvert replacement and road upgrade, headwalls would be used to maintain the road width through the crossing. Additional drainage features may be necessary since the incised road segment would increase in length after excavating the required fill. These would be constructed according to Forest Service plans and specifications. Any areas disturbed by excavation or filling for the road crossing replacement would be covered with chipped or masticated material to prevent exposed soil. In addition, drainage features would be constructed such that exposed soil does not result (BMP 2-17).

Forest Service System Road 12N20

In the Osgood Swamp watershed, an existing crossing on Forest Service system road 12N20 at the end of Nez Perce Street has a vented ford with crushed pipes that is no longer functioning to pass the flow of the channel and is too narrow to allow equipment to cross without causing resource damage. Currently, this crossing is causing upstream aggradation and preventing fish passage. Prior to using this stream crossing for South Shore Project implementation, the stream crossing would be replaced. The new culvert would be a bottomless arched culvert, or suitable alternative, designed to pass the 100-year flood flow of the channel and to allow for unobstructed fish passage. This channel is a spring fed perennial stream that would require dewatering and flow diversion around the site during culvert replacement. The following specific installation criteria would reduce effects to water quality (BMP 2-15 and BMP 2-17):

- A diversion channel would be created adjacent to the stream channel and be lined with a synthetic material to avoid direct ground contact
- Coffer dams would be installed at the upstream and downstream ends of the culvert.
- Once water backs up sufficiently behind the upper coffer dam, gravity flow would move water into the diversion and around the crossing to the stream reach immediately downstream of the lower coffer dam;
- Any remaining water in the culvert 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 bottomless arched culvert would be installed with its footings extending below the existing channel to allow for a natural material bed.
- 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 replacement, water would be pumped to upland areas until the water quality is acceptable for discharge into the stream channel.

Treatment Prescriptions

Rationale Used in Developing Alternative 2

Within the South Shore Analysis Area, the units that were identified for treatment are overly dense forest stands with surface fuel accumulations at levels greater than desired conditions. Open stands with little fuel accumulations that meet the desired conditions described below would not be treated.

The treatment prescription for any individual unit including the thinning method and follow up treatments proposed are based on soil type, slope, associated water quality protection, access, habitat conservation or other protection needs. Application of the treatment methods are guided by project desired conditions and modified by the resource protection measures described later in this chapter.

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 trees per acre (TPA) that are 10 inches at dbh, or 132 TPA that are 20 inches dbh. Trees are able to withstand drought conditions better when at lower stand densities with sufficient available growing space and resources and when inter-tree competition does not have a large effect on stand growth (Long 1985). For the South Shore project, maximum SDI is used for analysis in determining stand density conditions for each alternative. The desired stand densities for overall forest health objectives as measured in SDI is about 40% of the maximum. In order to implement appropriate stand density levels, basal area as measured in square feet per acre, was also used in correlation with the desired SDI levels.

Basal area is the cross sectional area of a tree bole measured at diameter at breast height (dbh), which reflects varying levels of stand densities depending on a stand's average diameter. Basal area is used as a measure of stand density which corresponds to forest health issues such as mortality due to competition among trees as they fight for water and soil nutrients, and susceptibility to insect and disease outbreaks.

To meet the desired condition, the objectives of the treatment are to reduce the current stand density of approximately 160 to 350 ft2 basal area per acre by removing live understory trees to achieve a residual stand density of 80 to 150 ft2 basal area per acre. When basal areas exceed levels of about 150 ft2 per acre, bark beetle populations are more likely to expand into outbreak levels, killing a large number of trees (Fettig et al. 2007). Optimal levels at which infestation is less likely would be approximately 80 ft2 per acre.

Basal area is used as a measure for implementation in the mechanical units. The hand thinned units, however, use the associated number of trees per acre (tpa) that should be left as residuals to meet the desired density levels.

Fuel models (Anderson, H.E, 1982) are used to estimate fire behavior, are applied when using some fire behavior models, and used as a tool for determining fuels treatments. Stands that have representative fuel models with fuel loads that are less than 6 tons per acre in the 0" to 3.0" size classes tend to have a surface fire type of fire behavior with low to moderate torching.

Objectives of the treatment are to remove surface fuels, such as down trees, to achieve a maximum residual surface fuel load of 10 tons per acre. In areas where stream zones or other wildlife habitat require a higher component of large down wood, a maximum of 15 tons per acre is acceptable. The desired fuel loading of 10 tons per acre is based on having up to approximately 4 tons per acre in the 0" to 3.0" size classes and allowing for approximately 6 tons of larger down logs per acre.

This range is also described as the "optimum of coarse woody debris for providing acceptable risks of fire hazard and fire severity while providing desirable quantities for soil productivity, soil protection, and wildlife needs" (Brown et al, 2003).

Guidelines

In attaining the above objectives a number of guidelines were applied to each treatment unit to create the prescriptions proposed in Alternative 2. The guidelines are listed below and are organized by activity. Direction for uplands is separated from SEZs because the treatment methods are identifiably different and these are typical landform delineations in the Lake Tahoe basin environment.

The guidelines section is organized under the following headings.

- Uplands
    - Mechanical Thinning
    - Hand Thinning
- Stream Environment Zones
    - Mechanical Thinning
    - Hand Thinning
    - Aspen Treatments
- Wildlife Areas
- Prescribed Fire
- Mastication and Chipping
- Lop and Scatter

Uplands

Mechanical Thinning Units

- Mechanical treatments would be used to reduce upland hazardous fuels on slopes less than 30%.
- Live tree density would be reduced through thinning understory trees. Primarily 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 forest structure are reached.
- Jeffrey pine and sugar pine would be favored for retention.
- Snags and down logs would be removed as necessary to meet fuels objectives, retaining the largest snags and down logs present to meet Forest Plan wildlife requirements.
- To achieve the desired conditions for fuel loads, stand densities, and forest structure, live and dead trees removed would range between 3 to 30" diameters at breast height (dbh). In some situations trees larger than 30" dbh might need to be removed for equipment operability and safety.
- The type of mechanical equipment used for thinning and removal operations would depend on vegetation removal needs and operational feasibility. They would include WT using mechanical harvesters and whole tree skidding, and CTL harvest with log-forwarding operations. Treated material could be removed either as saw logs (whole tree or cut-to-length), fuelwood, or biomass.
- 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

- Hand treatments would be used to reduce hazardous fuels on slopes greater than 30%, where mechanical ground-based systems are limited by operability constraints (access, excessive moisture, rocks, etc.) (BMP #5-2).
- Live tree density would be reduced through thinning understory trees 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.
- Jeffrey pine and sugar pine would be favored for retention
- For hand thinning treatments, live trees up to 20" dbh would be removed based on achieving the desired stand densities and fuel loads. The portion of a felled tree that is greater than 14" dbh would be left on site while the remainder would be included in on site hand piles for later burning.
- Where current fuel loads are predicted to remain above desired levels after thinning and follow-up treatment (e.g. prescribed burning), multiple entries may be required to bring the areas into the desired condition. Approximately 1,287 acres of hand thinning treatments may require multiple entries as part of this project.
- Dead trees removed would range up to 20" dbh, and down logs would range between 3" to 20" in diameter.
- Hand thin units, in both uplands and SEZs (not wildlife areas) would be thinned to approximately 70 to 100 trees per acre. Wildlife areas would leave up to 160 trees per acre in order to maintain wildlife habitat.

Stream Environment Zones (SEZ's)

Mechanical Thinning

- Mechanical equipment operations in SEZs would be limited to CTL 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) (BMP 5-3).
- SEZ units 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 with operable soil moisture conditions (see Soil, Water and Riparian resource protection measures).
- SEZ units that rate more sensitive than the HSEZ site would be treated by hand thinning, endlining, or mechanical over-snow operations.
- When units are rated more sensitive than the HSEZ site, but only a portion of the unit is responsible for the high sensitivity rating, the less sensitive part may be treated with mechanical equipment, but the sensitive portions of these units 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, 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 retain stream shading, and reach the desired residual stand density and wildfire behavior. In some situations trees larger than 30" dbh might need to be removed for equipment operability and safety.

- Snags and down logs would be removed as necessary to meet fuels objectives, retaining the largest snags and down logs present to meet Forest Plan wildlife requirements.
- Basal areas greater than 150 ft^2 may be prescribed where needed to maintain desired stream shading.
- Jeffrey pine and sugar pine would be favored for retention, as well as desired riparian species, such as aspen and willow.
- If feasible, treated material would be removed as saw logs, fuelwood, or biomass.
- Fuel material not removed may be treated on site through prescribed burning.
- To provide ground cover and protect soil resources in areas of ground disturbance, including forwarding trails and temporary roads, activity slash would be left, or masticated, or chipped and spread over the disturbed areas, with a maximum depth of approximately 4”.

Figure 8. Example of cut to length mechanical SEZ treatment. Heavenly SEZ Demonstration project. Location: Pioneer Trail at Al Tahoe Blvd, South Lake Tahoe.

Hand Thinning

- 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 greater than 150 ft^2 may be prescribed where needed to maintain desired stream shading.
- Where feasible ground fuels exceeding 15 tons per acre would be removed from the 50-foot piling exclusion buffer around lakes and perennial and intermittent stream channels and be treated by hand piling and burning outside the piling exclusion buffer.

Aspen Treatments

Aspen stands are unique habitat components of SEZs. For the South Shore project there are approximately 290 acres of aspen stands that are included in the SEZs proposed for treatment. In addition to the objectives listed above for mechanical and hand treatments in SEZs, the following guide treatments for aspen stands.

- For aspen units where lodgepole pine and other conifer species are encroaching, the prescribed treatment would include the removal of live conifers to increase the amount of hardwood vegetation that currently exists to restore aspen species dominance.
- The general prescription for hand treatments would primarily include removing all live and dead conifers up to 20” dbh. All 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 aspen stands post-thinning could also be included for treatment.
- Vegetation treatments proposed within aspen units would result, where possible, in the following desired conditions:
    - average conifer crown closure less than 25%;
    - average aspen crown closure greater than 40%;
    - 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.
- Burning piles in aspen would be avoided when possible to minimize risk of mortality to aspen roots and trees and the risk of reducing site suitability for aspen growth and regeneration (e.g., killing live roots or inducing soil hydrophobicity).
- The LTBMU/Rocky Mountain Research Station (General Technical Report) GTR-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 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 resource protection measures for aspen.

Wildlife Areas

This section describes the guidelines for what collectively are called "wildlife areas" in the South Shore project. They include California spotted owl protected activity centers (PACs) and Home Range Core Areas (HRCAs), northern goshawk PACs, TRPA disturbance zones for northern goshawk and osprey, and TRPA bald eagle wintering habitat. Wildlife areas include both upland and SEZ landscapes. Treatments within wildlife areas would include both mechanical and hand methods to achieve the guidelines described below.

- Vegetation treatments within northern goshawk PACs, within California spotted owl PACs, and within TRPA goshawk disturbance zones would 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) approximately 5 logs larger than 20" in diameter (at the large end) and of variable decay classes, totaling 10-12 tons of coarse woody debris (CWD) per acre. These conditions would be met where possible, otherwise as closely as possible.
- Vegetation treatments within California spotted owl home range core areas (HRCAs), would 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) approximately 4 logs larger than 20" in diameter (at the large end) and of variable decay classes, totaling 8-10 tons of coarse woody debris (CWD) per acre. These conditions would be met where possible, and otherwise adhered to as closely as possible (as available material).
- Vegetation treatments within osprey stands adjacent to Fallen Leaf Lake and Lower Echo Lake would result in: 1) retention of all known standing osprey nest trees; and 2) for future nest tree recruitment the 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.
- 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.

Prescribed Fire

- Piling of existing surface fuels and activity fuels for follow-up burning would occur primarily in units treated with hand thinning. Machine piles may also be created in some areas of the mechanically thinned (CTL) units.
- Piles would be located outside of designated exclusion zones and modified piling specifications would be applied in areas where piling is allowed within SEZs.
- Only hand piling would occur within SEZs, no machine piling.

- Prescribed burning would be used for reducing fuel loads in excess of maximum desired levels of 10 tons per acre. Up to 15 tons per acre would be acceptable in SEZs or wildlife areas.
- Lop and scattering of fuels followed by a prescribed underburn would occur in some of the mechanically thinned (WT) units.
- Prescribed pile burning and underburning would only occur under approved conditions as described in a Burn Plan that is approved for that area by the line officer.
- Scorch to residual trees is expected and mortality of up to 15% is acceptable.

Figure 9. Example of prescribed fire, pile burning, after treatment. Location: Slaughterhouse Canyon, East Shore Lake Tahoe, NV.

Mastication and Chipping

- Mastication or chipping would be applied primarily to the CTL units for treating surface and activity fuels. Areas within hand thinned units that have access and where slopes are less than 30% would also be treated with mastication or chipping.
- Mastication or chipping would only occur where fuel loads would not exceed 10 tons per acre or 15 tons in SEZs or wildlife areas.

Lop and Scatter

- Lop and scatter would be applied primarily to the units treated with whole tree logging operations.
- Lop and scatter would only occur where fuel loads would not exceed 10 tons per acre or 15 tons in SEZs or wildlife areas, unless followed-up with a prescribed underburn.
- Lop and scatter would not exceed 18 inches depth.

Alternative 3 – Preferred Alternative

Alternative 3 is a modification of Alternative 2 (the Proposed Action) in response to public and other agency comments received during scoping expressing concerns regarding watershed impacts and impacts within Northern goshawk and spotted owl PACs (Issues, Chapter 1)

Alternative 3 uses the same thinning method options, follow up treatments and treatment prescriptions as Alternative 2 but prescribes changes to where the treatments are applied on the ground based on the rationale presented below. Three combinations of treatment changes were used to arrive at Alternative 3. These include the following:

1) from WT methods to CTL methods, hand treatments, or no treatment;
2) from CTL to hand treatment or no treatment, and
3) from hand treatment to no treatment.

Compared to Alternative 2, Alternative 3 treats 558 fewer acres total (10,112 acres). In addition Alternative 3 proposes 1,045 acres more hand treatments, 100 acres more CTL, but 1,677 acres less WT treatments. Up to 442 more acres may require more than one entry to bring the areas into the desired condition due to high fuel loads and densities of small trees.

Vegetation Treatments

The table below summarizes the acres by treatment type proposed in Alternative 3 as a result of the rationale described in Table 2-3, and based on field review, data review, and fire behavior modeling. The differences between Alternative 2 and Alternative 3 are compared at the end of this chapter.

Table 2-3. Summary of Thinning Method Acres Proposed in Alternative 3

	Mechanical Thinning		Hand Thinning	Total
	WT	**CTL**		
Upland	1971	1625	5823	9419
SEZ	170 [1]	385	138	693 [2]
Method Subtotal	2141	2010	5961	10112
Total	4151			

Notes:
[1] Estimate of SEZ inclusions within WT units.
[2] SEZ acres include aspen treatment acres.

Implementation Schedule Limitations

The same implementation schedule concept was used for Alternative 3 as was described in Alternative 2, when describing the timing of treatments within watersheds. As a result of changes in thinning method prescriptions that reduce risk to watersheds, the maximum treatment acres for each HUC7 watershed were revised for Alternative 3, to account for changes in treatment type acres. For example, a conversion of more treatments to hand thinning, and a reduction in overall treatment acres, adjusted the maximum acres available for treatment in a given year. The distribution of treatments across watersheds for this alternative is analyzed in Chapter 3, Water and Riparian Resources section.

Follow up Treatments

As described in Alternative 2, follow up residual fuel treatments are assigned based on individual treatment unit requirements after thinning has been completed to meet fuels treatment objectives and desired conditions, and are therefore designed independently from the thinning method used. In some cases follow up treatment methods may overlap, for example some units may be partially treated by hand piling and also broadcast burning. As a result of changing where the thinning methods are applied on the ground there is a corresponding change in the estimated acres where the different residual fuels removal methods would be applied. Table 2-4 shows the estimated acres by method and landscape type.

Table 2-4. Estimated Follow-up Treatments Proposed in Alternative 3

Follow up Treatment Method	Associated Thinning Method	Upland Acres	SEZ Acres	Total Acres
Lop & Scatter	WT, CTL, HT	1616	170	1786
Mastication/Chipping	WT, CTL, HT	2617	0	2617
Underburning (lop and scatter)	WT, CTL, HT	774	28	802
Pile & burn	HT	5217	138	5355
Grapple pile & Burn	CTL	374	0	374
Landings – pile burning and/or removal	WT	77	0	77

Roads and Access

As a result of changes in the treatment prescription from Alternative 2 the need for temporary roads and landings would be reduced in Alternative 3. The reconstruction of three crossings described in Alternative 2 does not change.

Landings – An estimated 168 landings would be needed to support the proposed thinning activities proposed in Alternative 3. This is 50 less than Alternative 2.

System Road Management – Alternative 3 would use the same 26.7 miles of existing system roads as Alternative 3 but fewer miles of road would need reconstruction and more miles would need only maintenance than Alternative 2. Of the FS System roads used, 15.7 miles would receive maintenance activities and the remaining 11.0 miles would need reconstruction.

Temporary Roads – Alternative 3 would construct 12.3 miles of temporary road. The reduction of temporary roads is a consequence of fewer WT units proposed in Alternative 3. Of the total mileage proposed 6.5 miles is on old existing road prisms and only 3.3 miles requires new construction. Decommissioning of temporary roads and stream crossings would be the same as in Alternative 2. Ephemeral and intermittent crossings are unchanged from Alternative 2.

Crossing and Culvert Replacement - Alternative 3 proposes the replacement of the same three existing permanent stream crossings as described under Alternative 2. One of these is on an intermittent channel in the Lower Trout Creek watershed (12N01A), one is on an ephemeral channel in the Cold Creek watershed (12N08), and one is on a perennial channel in the Osgood Swamp watershed (12N20).

Rationale Used in Developing Alternative 3

Overall the same desired conditions, objectives and guidelines used in Alternative 2 were applied to create Alternative 3. They were employed in a slightly different configuration on the ground as shown in the tables above in response to the two issues described in Chapter 1, Watershed Impacts and Wildlife areas.

Watershed Impacts

Alternative 3 was formulated to respond to comments during scoping to create an alternative with fewer or reduced proposed activities in sensitive areas. Changes from Alternative 2 were made on a site-by-site basis and were made based on a variety of interdisciplinary factors such as soils, erosion hazards and terrain limitation and not any singular set of evaluation criteria. The results are presented in the tables above.

Wildlife Areas

Changes to treatments aimed at reducing impacts to sensitive species and their habitats were proposed in Alternative 3 based on the following: spatial extent of northern goshawk and California spotted owl PACs, 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).

In the WUI defense zone, proposed treatments were evaluated 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 PAC treatment prescription for fuels reduction detailed in Alternative 2 remain the same in Alternative 3.
- Where a surface fire was predicted for a unit, no treatment within the PAC is proposed in Alternative 3. Surrounding unit treatments were not changed; PAC boundaries were not adjusted.

In the WUI Threat Zone, proposed treatments were evaluated within spotted owl and goshawks PACs based on the factors of feasibility of implementing prescribed fire, and 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 remain the same in Alternative 3.
- Where fire behavior modeling indicated the landscape fire to be a surface fire, no treatment within the PAC is proposed in Alternative 3. Surrounding unit treatments were not changed; PAC boundaries were not adjusted.

Review of the suitable habitat available for other sensitive species, such as osprey and bald eagle, resulted in a 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.

Resource Protection Measures

Resource protection measures are intended to avoid, eliminate or reduce unintended and undesirable effects of the proposed activities. The following tables display the resource protection measures categorized by resource area. The resource protection measures apply to both Alternative 2 and 3 but some may be specific to units. The last column references the related BMP and/or source of the protection measure if it contains direction from applicable policy or management direction. *(Note: The DEIS used the term "design feature". However, the term "resource protection measure" is more descriptive of the purpose of the direction contained in this section so it has been incorporated into the FEIS.)*

Changes from the DEIS – The resource protection measures have been edited from the version presented in the DEIS. They have been compiled in tabular format and numbered for ease of reference. Duplicative measures have been removed. The Soils section has been combined with the Water Quality section to eliminate much of the duplication in the DEIS. Appendix C has been revisited to include only the text of R5 BMPs. The replication of resource protection measures found in the DEIS was removed from that Appendix. In the FEIS all measures are listed here in this section. Some of the measures were edited to provide clarity where public comment indicated the intent of the measure was not well understood.

Air Quality

Goal:

- Follow agency and air resource board smoke management requirements.

I. Air Quality- General			
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
AQ-1	Scheduling of prescribed burn activities would comply with air quality standards and restrictions	Project Wide	NAAQS, CARB, EDAQMD

Pest Management

Goal:

- Prevent introduction and spread of annosus root disease.

II. Pest Management - General			
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
P-1	Live true fir and pine tree 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 be applied to conifer stumps within 24 hours of creation. • 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.	Project Wide	FSH 3409.11 SNFPA S&G 97

Focal Wildlife Species

Goals:

- Wildlife objectives and resource protection measures 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 amended LTBMU Forest Plan (USFS); special interest species (SIS) by the Tahoe Regional Planning Agency (TRPA); and FWS migratory land bird species.
- Focal wildlife species are addressed in the biological evaluation and biological analysis (BE/BA), MIS report, TRPA impact analysis report, and/or migratory land bird report for this project. Limited operating periods (LOPs) will apply, following the recommendations of the project biologist, consistent with SNFPA, LRMP, and TRPA Code of Ordinances direction for wildlife species as presented below.
- Implementation of LOPs for marten and/or fisher dens, great gray owl PACs, and Yosemite toad sites is not expected as they have not been discovered, delineated, or known to occur within the wildlife analysis area. The bald eagle and golden eagle nest sites known within the wildlife analysis area are located farther from project activities (approximately 1¼ miles and ½ mile, respectively) than TRPA's recommended resource protection measure distances (½ and ¼ mile, respectively). LOPs will be evaluated annually and recommendations made based on current information. Recommendations presented below for LOPs, by treatment unit, are based on information current prior to the 2010 breeding season. LOPs may be modified during an implementation season following direction from the Forest Plan, as amended by the SNFPA (standards and guides 58, 77, 78, and 79), and the TRPA Code of Ordinances (Ch. 78.3). Additionally, LOPs often apply only to a portion of each unit.

III. Focal Wildlife Species - General			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WL-1	For California spotted owl protected activity centers (PACs), maintain a limited operating period (LOP) prohibiting vegetation treatments, prescribed fire, or road or trail building within approximately ¼ mile of the activity center, if known, or within ¼ mile of the PAC, if unknown, during the breeding season (March 1 to August 15).	Units 2, 3, 7, 9, 11, 12, 14, 41, 47, 49, 59, 62, 81, 83, 86, 96-99, 107-8, 114, 116, 127-29, 131-32, 139, 169-72, 190-97, 200, 213, 307-09, 311, and 345	SNFPA S&G 75
WL-2	For northern goshawk PACs, maintain a LOP prohibiting vegetation treatments, prescribed fire, or road or trail building within approximately ¼ mile of the activity center, if known, or within ¼ mile of the PAC, if unknown, during the breeding season (February 15 to September 15).	Units 2, 3, 7, 9, 11-12, 38, 59, 64, 67-68, 70-71, 74, 79, 80, 87-90, 116, 132, 139, 169-72, 183-87, 19097, 199-200-201, 209-10, and 216	SNFPA S&G 76
WL-3	For northern goshawk disturbance zones, maintain a LOP restricting management activities, including habitat manipulation for purposes other than habitat improvement, within approximately ½ mile of existing nest trees located outside urban zones from February 15 to September 15.	Units 1-3, 7, 9, 11-12, 15, 59, 62-63, 69, 80-81, 83-91, 116, 129, 132, 139, 162, 169-71, 190-96, 200, 202, 204-205 and 213	TRPA Ordinance 78.3
WL-4	For the bald eagle winter habitat near Taylor and Tallac creeks, maintain a LOP restricting management activities, including habitat manipulation for purposes other than habitat improvement, from October 15 to March 15.	Units 40, 42-43, 46, 54, 120-21	LRMP Fallen Leaf practice 12 and TRPA Ordinance 78.3
WL-5	For suitable habitat surrounding an active willow flycatcher nest, maintain a LOP prohibiting vegetation treatments, prescribed fire, or road or trail building during the breeding season (June 1 to August 31).	Units 34, 40, 43, 97, and 212	SNFPA STD/GD 58

III. Focal Wildlife Species - General			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WL-6	For osprey disturbance zones, maintain a LOP restricting management activities, including habitat manipulation for purposes other than habitat improvement, within approximately ¼ mile of the nest during the breeding season from March 1 to August 15.	Units 1, 3, 15, 33, 40, 47, 54, 114, 120-21, 134-40, 149, 170, 211, 213, and 219	TRPA Ordinance 78.3
WL-7	For peregrine falcon disturbance zones, maintain a LOP restricting management activities, including habitat manipulation for purposes other than habitat improvement, within approximately ¼ mile of the nest from April 1 to September 30.	Unit 93	TRPA Ordinance 78.3
WL-8	Where available an average of four of the largest diameter snags and four downed logs per acre would be retained. Snags would be at least 15” dbh in clumped and irregular spacing, depending on the average size class in the stand. (This does not supersede the removal of hazard trees.	Project wide except in Wildlife Areas where a specific snag retention is prescribed	SNFPA S&G # 10 and 11

Aquatic Resources

Goals:

- SEZ fuels reduction treatments in identified Lahontan cutthroat trout habitat are designed to avoid negative habitat effects and meet Endangered Species Act (ESA) conservation and recovery goals.
- Maintain riparian associated shrub and herbaceous vegetative cover, floodplain connectivity commensurate with expected channel geometry, and large woody debris to achieve high quality aquatic habitat.
- 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 adequate stream shading to ensure that daily mean water temperatures do not increase as a result of SEZ fuel reduction treatments.

IV. Aquatic Resources - General			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
AR-1	Leave existing downed trees and CWD that are in perennial or intermittent stream channels in place unless removal is needed to maintain channel stability, as determined by a Forest Service watershed specialist or fish biologist.	Project wide	SNFPA S&G 103 LRMP S&G 15
AR-2	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, as approved by the fisheries biologist and watershed specialist, only where fuel loads or stand densities exceed desired conditions and where CWD is at or above desired levels or where trees are a hazard to safe operations.	Project wide	SNFPA S&G 103

IV. Aquatic Resources - General			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
AR-3	Use directional falling to keep felled trees out of intermittent and perennial streams unless the channel reach is identified as deficient in coarse woody debris or such trees are needed for stream shade, in which case a FS fisheries biologist and watershed specialist would select trees greater than or equal to 12 in DBH to be felled directionally into the channel. Current data indicates that stream segments in units listed, lack CWD to varying degrees. A Forest Service fisheries biologist and watershed specialist would evaluate stream segments for CWD desired conditions and select trees greater than 12" dbh to be felled directionally into the channel to improve aquatic species habitat.	Units 22, 24, 25, 51, 52, 56, 59, 63, 84, 85, 87, 88, 89, 95, 96, 97, 100, 127, 129, 132, 133, 145, 310, 311, 312	SNFPA S&G 102 SNFPA S&G 103 SNFPA S&G 108
AR-4	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. 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.	Project wide	LRMP S&G 20 SNFPA S&G 96

Soil, Water, & Riparian Resources

Goals:

- Provide the water quality and soil productivity necessary to support ecological functions and beneficial water uses.
- Implement Region 5 Best Management Practices and project-specific resource protection measures to meet California State water quality standards.
- Meet the riparian conservation objectives of the forest plan, as amended by the SNFPA (2004).
- Maintain connections between floodplains, channels, and water tables to distribute flood flows and sustain diverse habitats.
- 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.
- Maintain soils with favorable infiltration characteristics and diverse vegetative cover to absorb and filter precipitation and sustain favorable conditions for stream flows.

Background Rationale for Resource Protection Measures

In order to minimize impacts to water resources from the proposed activities, standard BMPs would be implemented (USDA FS 2000). BMPs are standard management practices that have been developed to protect soil and water, as described in the Region 5 USFS Best Management Practices Handbook. These practices and procedures provide the structure for water quality management for the Pacific Southwest Region (Region 5). The BMPs comply with Section 208 and 319 of the Clean Water Act, and the guidelines of the Water Quality Control Board Basin Plans. Implementation of these State certified and EPA approved BMPs meet the Forest Service obligations for compliance with water quality standards and fulfill Forest Service obligations as a designated Water Quality Management Agency. The basic premise and emphasis for BMPs and the project-specific resource protection measures to implement them are to prevent sources of erosion and dissipate or infiltrate runoff generated by the project before reaching waterbodies. (See Appendix B for a listing of BMPs.) The purpose of the resource protection measures and BMPs is to prevent the source of erosion, rather than to treat erosion after it has occurred. The resource protection measures and BMPs included in the South Shore project design are effective at avoiding or reducing sediment delivery, including the fine sediment fraction (i.e., $<16\ \mu m$).

The project specific resource protection measures 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 (SNFPA, 2004). The riparian conservation objectives (RCOs) in the SNFPA (2004) are incorporated in the design for the project as described in the RCO Analysis Report (Project Record #J14). These objectives address provision of beneficial uses for water resources, geomorphic and biological characteristics of aquatic features, suitable stream habitat features (including CWD), and physical and biological characteristics of riparian areas.

An 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). This SEZ sensitivity rating system was used over two consecutive field seasons for designation of types of treatment on SEZ units in the project (Appendix C).

Soil type and slope data were analyzed to determine areas that are suitable for mechanical treatments. Vegetation treatments are designed to minimize adverse effects to soils, and maintain productivity. BMPs and resource protection measures specific to prescribed burning would be used to prevent negative effects to soils from prescribed fire duration or intensity.

Normal operating period is generally considered to be from May 1 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. Resource protection measures 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 resource protection measures that apply in wet conditions).

V.	**Soil, Water, Riparian - General**		
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-1	Spill prevention and cleanup of hazardous materials would be implemented in accordance with FS timber sale type B contract clauses and in accordance with the LTBMU Hazardous Spill Notification and Response Plan.	Project Wide	BMP 2-12
WS-2	Watershed or transportation specialist will review project BMPs prior to a large storm event (1 inch or greater) that may exceed BMP capacity and will notify contract administrator if additional BMPs are recommended to disconnect runoff from surface water features (see implementation monitoring, chapter 4).	Project Wide	LTBMU Practice
WS-3	To minimize compaction, gullying, and rutting, ground based operations would be conducted only when soils are dry to moist at the 4-8 inch depth. This determination would be made by a LTBMU watershed specialist or contract administrator, using Appendix D as a guideline.	Project Wide	BMP 1-5 BMP 1-13
WS-4	Design underburning prescriptions to avoid adverse effects on soil and water resources by planning prescribed fire to ensure that fire intensity and duration do not result in severely burned soils.	Project Wide	LRMP S&G 53 and 54

V. 1) Soil, Water, Riparian – Vegetation treatments in uplands (during normal operating period and dry conditions)			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-5	Install water bars on skid trails to provide proper drainage and prevent erosion when operations are complete and prior to a large storm event (1 inch or greater). Design and minimum spacing of water bars would be in accordance with the Forest Service Timber Sale Administration Handbook. Water bars may be required on forwarder trails if surface cover is not adequate to control erosion.	Project Wide	BMP 1-17 FSH 2409.15
WS-6	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 Forest Service implementation monitoring finds potential for sediment delivery, contractor would rake in the berms from ruts created by end-lining.	Project Wide	LTBMU Practice

V. 2) Soil, Water, Riparian – Vegetation treatments in SEZs (during and outside of normal operating periods).			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-7	Ensure that all exclusion buffers are flagged during all project activities.	Project Wide	LTBMU Practice
WS-8	Flag and avoid equipment use in and adjacent to special aquatic features (springs, seeps, fens, and marshes); use hand treatments in these areas. Refer to the Sensitive Plants resource protections measures for prescribed buffers specific to sensitive plant species.	Project Wide	BMP 1-22
WS-9	Flame heights for underburning would 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.	Project Wide	LRMP S&G 53 and 54 BMP 6-2 and 6-3 SNFPA Std 111
WS-10	Where it is necessary to cross an SEZ area with inoperable soil moisture conditions, equipment would operate over a slash mat, landing mat, or other protective material to minimize soil compaction. If slash is used, it would be removed when operations in the area are concluded. The Contract Administrator will determine the crossing location and method.	Project Wide	BMP 1-5 BMP 1-13
WS-11	Prohibit equipment operations in ephemeral channels. Ephemeral crossings would be avoided where feasible, and where necessary, would be limited to 1 crossing every 800 feet of channel, as determined by the Contract Administrator.	Project Wide	BMP 1-19

V. 3) Soil, Water, Riparian – In Cut to Length Units			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-12	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). Use the SEZ Risk Rating (Appendix C) to determine operability of part or all of the SEZ.	CTL units	BMP 1-13, 5-3, 1-18 SNFPA Std 92 and 113
WS-13	Within 25 feet of perennial or intermittent streams and other water bodies (i.e. lakes and ponds) CTL tree removal methods would be limited to reaching in and removing logs where ground contact can be avoided to mitigate ground disturbance. Contract administrator would consult with LTBMU watershed specialist to determine additional needed buffer widths, based on proximity to Lake Tahoe and perennial channels, slope steepness (greater than 20 percent), and amount of existing ground cover (less than 30 percent).	CTL units	BMP 1-19

<table>
<tr><th colspan="4">V. 4) Soil, Water, Riparian – In Whole Tree Units</th></tr>
<tr><th>Ref #</th><th>Resource Protection Measure</th><th>Location</th><th>BMP/Source Reference</th></tr>
<tr><td>WS-14</td><td>For WT operations, the following table would be used to determine equipment exclusion buffers for perennial channels, lakes and ponds:
<table>
<tr><th></th><th colspan="2">Soil Cover</th></tr>
<tr><th>Slope</th><th>< 75%</th><th>> 75%</th></tr>
<tr><th>< 20%</th><td>75 ft</td><td>50 ft</td></tr>
<tr><th>> 20%</th><td>100 ft</td><td>75 ft</td></tr>
</table>
A minimum 25 ft buffer would still apply in WT treatments units for intermittent channels.
A minimum 10 ft buffer from the top of steep slopes (>30%) that are connected to an SEZ would also apply for whole-tree equipment exclusion.
Contract administrator would consult with LTBMU watershed specialist to determine additional needed buffer widths, based on proximity to Lake Tahoe and perennial channels, slope steepness (greater than 20 percent), and amount of existing ground cover (less than 30 percent).</td><td>WT units</td><td>BMP 1-19</td></tr>
<tr><td>WS-15</td><td>Ground based equipment would not operate within the equipment exclusion buffer for WT, (see WS-14) except at temporary or permanent stream crossings, but may reach in to remove material.</td><td>WT units</td><td>BMP 1-19</td></tr>
<tr><td>WS-16</td><td>Ground based equipment in WT treatment stands would not operate in SEZs. 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.
a) Provide ground cover adequate to prevent erosion in disturbed areas, such as slash, wood chip, or masticated material.
b) Where implementation monitoring finds potential for sediment delivery, contractor would rake in the berms from ruts created by end-lining.</td><td>WT units</td><td>BMP 1-19
BMP 1-22
BMP 5-3
BMP 1-18
LRMP S&G 43</td></tr>
</table>

V. 5) Soil, Water, Riparian – Hand piling and Pile burning in SEZs			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-17	Avoid piling slash within 50 ft of perennial or intermittent streams, lakes, bogs, and fens. Slash would not be piled in springs and seeps.	Project Wide	BMP 6-3LRMP S&G 53
WS-18	Permit piling and burning up to 10 feet from the edge of ephemeral channels.	Project Wide	BMP 6-3
WS-19	Allow fire to creep between piles and into these buffers, maintaining a burn intensity that would protect soil and water resources. Do not allow fire in flagged areas with sensitive plant occurrences or noxious weeds.	Project Wide	BMP 6-3 SNFPA S&G 111
WS-20	No more than 15 percent of any SEZ acre may be piled for burning in a given year (based on an average pile diameter and an average pile spacing of 10 feet).	Project Wide	LTBMU Practice SNFPA S&G 111
WS-21	After initial ignition of piles, but while still burning, allow each pile to be re-piled once (i.e., place unburned pieces back into the burning pile). Additional re-piling will be allowed if necessary to achieve 80 percent consumption of the piled material, except for piles adjacent to aspen.	Project Wide	LTBMU Practice SNFPA S&G 111
WS-22	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).	Project Wide	LTBMU Practice SNFPA S&G 111

V. 6) **Soil, Water, Riparian – Landings**			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-23	All reasonable efforts 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.	Project Wide	BMP 1-12 LTBMU Practice
WS-24	Prohibit landings, fuel storage, and refueling in SEZs.	Project Wide	BMP 1-12 BMP 2-12
WS-25	Locate landings and refueling areas outside RCAs where operationally feasible. Prohibit fuel storage in RCAs. Procedures and spill prevention control measures for hazardous materials of any amount are included in project contract clauses.	Project Wide	BMP 2-12 BMP 7-4 SNFPA S&G 99 LTBMU Haz. Spill Notification & Response Plan
WS-26	Proper drainage from landings will be provided during use; ditching, sloping, and water bars or other BMPs may be used where needed as recommended by watershed specialist to disconnect runoff from surface water features.	Project Wide	BMP 1-16 LRMP S&G 10

V. 6) Soil, Water, Riparian – Landings			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-27	Restore landings after operations are complete using the following methods, as determined by the LTBMU Watershed Specialist: a) Providing ground cover, such as slash, wood chips or masticated material (spread no more than 6-inches thick). b) Ditching, sloping, and water bars may be used where needed as recommended by watershed specialist to disconnect runoff from surface water features. c) Landings will be ripped to approximately a 12-inch depth after ground cover has been spread. Ripping is not permitted in known infestations of noxious weeds, and may not be possible in rocky soils; this determination may be made by the Contract Administrator. d) Landings within 50 feet of an SEZ or greater than ¼ acre will be seeded with a native seed mix of grasses, forbs, and shrubs. Landings within 100 feet of noxious weed infestations may require seeding depending on weed species; consult with LTBMU botanist to determine if seeding is necessary.	Project wide	BMP 1-15 BMP 1-16 LRMP S&G 10 and 43

V. 7) Soil, Water, Riparian – Vegetation Treatments in Uplands (outside of normal operating period or wet conditions)			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-28	When working outside of the normal operating period, conditions must be adequate to prevent erosion, sediment delivery to water bodies, and soil compaction that would impact soil productivity or soil hydrologic function. Equipment operations would take place on portions of the treatment unit where adequate snow or frozen ground conditions are present while considering the above desired outcome. The following criteria will be applied in determining equipment operations: a. Frozen soil operations are permitted where operated vehicles, tractors and equipment can travel without sinking into soil and landing surfaces to a depth of more than 2 inches for a distance of more than 25 feet. Temperatures must also remain low enough to preclude thawing of the soil surface. b. For over-snow operations, maintain approximately 12 inches of compacted snow/ice on undisturbed ground, and 6 inches of compacted snow/ice on existing disturbed surfaces c. Lesser depths may be agreed to by a LTBMU Watershed Specialist and the Contract Administrator based on new and relevant research and monitoring.	Project wide	BMP 1-13 BMP 5-6
WS-29	If operable soil moisture conditions are present beneath a lesser snow depth (i.e., less than 6 inches), operations may continue until soil moisture conditions become inoperable (see Appendix D).	Project wide	BMP 5-6
WS-30	Flag and avoid springs, seeps, and other areas that do not freeze well.	Project wide	SNFPA S&G 118
WS-31	When working outside of the normal operating period, monitor operations daily when rain is probable. When temperatures rise, ensure that adequate snow and frozen soil depths are maintained during over snow/frozen operations.	Project wide	BMP 5-6
WS-32	Move equipment and materials to areas near pavement before conditions become inoperable.	Project wide	BMP 5-6

V. 7) Soil, Water, Riparian – Vegetation Treatments in Uplands (outside of normal operating period or wet conditions)			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WS-33	For over-the-snow and frozen soil operations in SEZs, use a 25 foot mechanical exclusion buffer on perennial and intermittent channels.	Project wide	BMP 1-19
WS-34	When adequate snow or frozen soil conditions are not present, temporary crossings on intermittent or ephemeral channels may be approved on a case by case basis through agreement between the contract administrator and a watershed specialist. Crossing density would be limited to 1 crossing every 800 linear feet of stream channel. Construct and maintain these crossings to prevent bank damage, water quality impairment, and obstructed flows.	Project wide	BMP 1-19

Transportation and Access (Roads)

Goal:

- Design the transportation system to Forest Service standards to support fuels reduction activities and equipment.

VI.	Roads - General		
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
R-1	Implement road BMPs during active periods of road use and at the conclusion of project activities	Project wide	BMP handbook LTBMU Practice
R-2	All native surface Forest Service roads that intersect with Forest Service paved or chip sealed roads would be stabilized through the use of aggregate base material (standard specification C or D) or wood chips to minimize tracking soils onto the pavement. Soil type, grade, and alignment will determine the extent of this stabilization.	Project wide	BMP 2-22 FP03
R-3	System roads would be reconstructed and/or maintained to Forest Service standards (including BMPs) that support equipment and trucks needed for project activities. These standards and BMPs are tailored to protect soil and water quality resources from impacts of the specific equipment classifications to be used for the project activities and disconnect road runoff from surface water features.	Project wide	BMP 2-22 FSH 7709.58
R-4	Roads would be watered for dust abatement at least as often as specified in FSH 2409.15. Water used for dust abatement would come from South Tahoe Public Utility District hydrants. Commercial dust palliatives may be used, if approved by the contract administrator.	Project wide	BMP 2-23 FSH 2409.15
R-5	Concrete mixing would only occur within an impenetrable, self-contained and removable container that provides protection from accidental runoff. Concrete mixers or sweepings would not be washed out within 50 feet of storm drains, open ditches, streets, SEZs, or waterbodies. Concrete washings and wastes would be stored in an impenetrable container for later disposal, and disposed of properly. Uncured concrete materials would be stored in a weatherproof area, away from SEZs and waterbodies.	Project Wide	BMP 2-2 FP03

VI. 1) Temporary Roads			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
R-6	New temporary roads would be out-sloped to ensure that effective drainage is maintained. BMPs would be installed as recommended by watershed or transportation specialist to ensure that temporary roads are hydrologically disconnected from intermittent and perennial stream channels. These BMPs could include lead-off ditches, water bars, rolling dips, etc. and would be installed during temporary road construction and maintained during the time the road is in use or at the end of operations each day if rain is predicted.	Project wide	BMP 2-1 BMP 2-4 BMP 2-5 LTBMU Practice
R-7	Encroachment permits would be needed to access City of South Lake Tahoe streets and/or Eldorado County roads from Forest lands. Stabilization of these easements may be required to minimize the tracking of debris and soils onto City streets. Streets would be cleaned of tracked dirt and debris as needed. On site meetings with city engineers would determine the extent and type of stabilization to utilize at each intersection. These intersections would be temporary, and be blocked or obliterated when the project is complete.	Project wide	LTBMU Practice BMP 2-22 CASQA
R-8	Temporary crossings on ephemeral drainages would be constructed and removed when the channels are dry (BMP#2-16). If channel is not dry at time needed for removal (eg end season winterization), implement dewatering BMPs prior to crossing removal.	Project wide	BMP 1-19 BMP 2-16
R-9	Temporary crossings on intermittent drainages would be constructed and removed when the channels are not flowing (BMP#2-16) and installed such that water flow and fish passage are not obstructed. If channel is not dry at time needed for removal (eg end season winterization), implement dewatering BMPs prior to crossing removal.	Project wide	BMP 1-19 BMP 2-16
R-10	Temporary crossings on intermittent drainages would be designed to accommodate a 1” or greater precipitation event and all Humboldt crossings would be removed before the winter season begins.	Project wide	BMP 1-19 BMP2-16

VI. 2) Roads (outside of normal operating period or wet conditions)			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
R-11	Unless adequate snow cover or frozen soil conditions exist, where a native surface road meets a paved road, the road intersection would be covered with rock or organic material to minimize tracking of soil onto the paved road.	Project wide	BMP 2-22 CASQA Equivalent to R-2, shown here to account for where stabilizing material does not exist under snow
R-12	If a native surface road becomes rutted, the road would be closed. If it is determined that stabilization of the road way can be accomplished by spot-rocking (application of an even grade sub-base material, FS Specification A, B, or equivalent) or other mitigation of rutted areas, road use may continue. Rutting is defined as greater than two-inch deep depressions more than 25 ft. in length.	Project wide	BMP 2-24 FP03
R-13	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.	Project wide	BMP 2-25
R-14	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 adequately to prevent rutting (as defined above). Ensure that plowing does not damage drainage structures or road surface.	Project wide	BMP 2-2 BMP 2-25
R-15	Road alignments within the contract area that require snow removal would be visibly marked on both sides along the entire alignment to facilitate plowing. Excess snow removed during plowing would not be placed into drainages or riparian areas.	Project wide	BMP 2-2 BMP 2-25
R-16	Before over-the-snow operations begin, mark existing culvert locations. During and after operations, ensure that all culverts and ditches are open and functional.	Project wide	BMP 2-25

VI. 2) Roads (outside of normal operating period or wet conditions)			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
R-17	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).	Project wide	BMP 2-25
VI. 3) Road Decommissioning			
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
R-18	At the conclusion of use, the road would be returned to the use designated in the applicable RMO. Designated Forest Service trails would be returned to their previous width.	Project wide	BMP 2-26
R-19	After mechanical operations are complete, and where feasible based on soil type, temporary roads would be restored by using the following methods. • Providing ground cover such as slash, wood chips, or masticated material (spread no more than 6 inches thick). • Removing all temporary crossings and installing drainage structures (such as water bars, dips, and leadoff ditches) as appropriate to prevent water accumulation on the decommissioned road surfaces as per FSH 2409.15. • Installing natural barriers such as large logs and rocks where necessary at road entrance points to prevent continued use of decommissioned road alignments. • For new temporary roads only: ripping where the rock content of the soil allows (generally <30-40% cobbles by volume), where noxious weeds are absent, and when soils are moist or dry. The Contract Administrator would determine whether ripping is feasible.	Project wide	FSH 2409.15 BMP 1-17 BMP 2-26
R-20	Barriers would be strategically established along open areas adjacent to roads or trails (boulders, split rail fence, and barriers/signs) to discourage post-treatment establishment of user-created routes	Project wide	BMP 4-7

Sensitive Plants

Goal:

- Minimize negative impacts to sensitive plants.

VII.	**Sensitive Plants - General**		
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
SP-1	Prior to project activities, flag all identified sensitive plant populations, sensitive plant communities and special interest Sphagnum areas with a protection buffer that extends 100 feet from the edge of the population. An LTBMU Botanist will help identify specific plant areas (on-site) during project implementation in Units 266 & 269. Identified populations:		R5 Sensitive Plant list LRMP LTBMU Practice SNFPA S&G 118
	Botrychium ascendens (upswept moonwort)	Unit 241	Above applies to all
	Botrychium minganense (Mingan moonwort)	40’ from Unit 9	
	Epilobium howellii (subalpine fireweed)	25’ from Units 82 & 84	
	Meesia triquetra (three-ranked hump-moss) *Meesia uliginosa* (broad-nerved hump-moss)	Unit 269 (Angora Fen)	
	Meesia triquetra (three-ranked hump-moss) *Meesia uliginosa* (broad-nerved hump-moss)	Unit 266	
	Meesia triquetra (three-ranked hump-moss)	Unit 84 (Fountain Place Fen)	
	Sphagnum sp. (sphagnum moss)	Units 186 & 187 (Osgood Swamp)	
	Sphagnum Fen *#1*	Unit 184	
	Sphagnum sp. (sphagnum moss)	Unit 187 (Sphagnum Fen #2)	

VII.	Sensitive Plants - General		
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
SP-1 Cont.	*Sphagnum sp.* (sphagnum moss)	Unit 183 & 184	
	Rorippa subumbellata (Tahoe yellow cress)	Unit 40	
	Meesia triquetra (three-ranked hump-moss) *Sphagnum* sp. (sphagnum moss)	Unit 22	
SP-2	No project activities would be allowed within flagged protection buffer, unless approved by forest botanist. These activities include hand or mechanical treatment, endlining and prescribed fire. Where safely feasible trees would be directionally felled away from buffered areas	Project wide	LTBMU Practice
SP-3	If any additional sensitive plants or sensitive plant communities are found during or prior to implementation they would be flagged, buffered, and avoided.	Project wide	LTBMU Practice

Sensitive Fungi

Goal:

- Minimize negative impacts to sensitive fungi from project activities.

VIII. Sensitive Fungi - General			
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
SF-1	LTBMU Botanists would be notified prior to any project implementation to flag monitoring plot.	Unit 83	LRMP LTBMU Practice

Noxious Weeds

Goal:

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

IX. Noxious Weeds - General			
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WE-1	Weed infestations identified within the project area (including travel routes and staging or landing areas) would be treated by approved methods or flagged and avoided and accepted for use by the Noxious Weed Coordinator before project implementation.	Project wide	SNFPA S&G 40 RNWMS Noxious Weed EA
WE-2	All off-road equipment used on this project would be washed before moving into the project area to ensure that the equipment is free of soil, seeds, vegetative material, or other debris that could contain or hold seeds of noxious weeds. “Off-road equipment” includes all logging and construction equipment and such brushing equipment as brush hogs, masticators, and chippers; it does not include log trucks, chip vans, service vehicles, water trucks, pickup trucks, and similar vehicles not intended for off-road use. When working in known weed infested areas equipment would be cleaned before moving to other National Forest System lands which do not contain noxious weeds. LTBMU Contract Administrator would document required equipment washing.	Project wide	SNFPA S&G 39 and 40 RNWMS

IX. Noxious Weeds - General			
Ref#	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
WE-3	All gravel, fill, or other materials are required to be weed-free. LTBMU Contract Administrator would inspect equipment and document certifications for weed-free materials. Use onsite sand, gravel, rock, or organic matter when possible.	Project wide	SNFPA S&G 40 RNWMS
WE-4	Use certified weed-free mulches and native seed sources for revegetation, including roads and landings. Seed mixes must be approved by a Forest Service botanist.	Project wide	SNFPA S&G 42
WE-5	Prohibit pile burning or underburning in infestations of species known to increase with fire.	Project wide	SNFPA S&G 40 RNWMS
WE-6	Minimize the amount of ground and vegetation disturbance in construction areas. Reestablish native vegetation where feasible on disturbed bare ground to minimize weed establishment and infestation. Revegetation is especially important in staging and landing areas.	Project wide	SNFPA S&G 40 RNWMS

Recreation

Goals:

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

X.	**Recreation - General**		
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
Rec-1	Minimize the extent and duration of temporary forest closures associated with mechanical treatments. Provide signage during closures informing the public of the reasons for the closure and alternative options for recreation access during the closure.	Project wide	LTBMU Practice
Rec-2	Schedule mechanical treatments where practical to avoid peak visitor use recreation times (July 1 – Labor Day) in and adjacent to the following developed recreation areas: Camp Richardson Resort, Camp Richardson Corral, Fallen Leaf Campground, Baldwin Beach, Tallac Historic Estates, and recreation residence tracts.	Project wide	LTBMU Practice
Rec-3	Provide information to the public through LTBMU visitor services regarding current and planned temporary forest closures associated with treatment units.	Project wide	LTBMU Practice

Scenic Resources

Goal:

- Develop treatment prescriptions consistent with the adopted visual quality objectives identified in the LTBMU Forest Plan.

XI.	**Scenic Resources - General**		
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
SR-1	Retain up to 15% of existing 4 to10-inch dbh trees and shrubs within foreground views (generally 100 feet) from the following travel routes: Pioneer Trail, Hwy 50, Hwy 89. Create irregular spacing and clumping distribution between trees and groups of trees within foreground views where practical.	Project Wide	LTBMU Practice LRMP S&G 3
SR-2	Design prescribed fires to retain up to 15% of selected understory vegetation, as well as to reduce evidence of tree scorching within foreground views (generally 100 feet) from Pioneer Trail, Hwy 50, and Hwy 89.	Project wide	LTBMU Practice LRMP S&G 3
SR-3	Minimize cut stump heights. Stump heights will not exceed approximately six inches measured from the uphill side.	Project wide	LTBMU Practice LRMP S&G 3
SR-4	Locate mechanical treatment landings beyond foreground views (generally 100 feet) from travel routes Pioneer Trail, Hwy 50, and Hwy 89 where feasible.	Project wide	LTBMU Practice LRMP S&G 3

Heritage Resources

Goal:

- Protect cultural resources during treatment activities.

XII.	**Heritage**		
Ref #	**Resource Protection Measure**	**Location**	**BMP/Source Reference**
HR-1	Identified cultural sites would be flagged and mechanical equipment would be prohibited	Project wide	Programmatic Agreement
HR-2	Use hand treatments to reduce wildfire effects within heritage sites.	Project wide	Programmatic Agreement
HR-3	Evaluate linear features to establish possible crossing areas.	Project wide	Programmatic Agreement
HR-4	Protect arborglyphs during prescribed fire	Project wide	Programmatic Agreement

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 each topic heading.

Utilizing Hand Thining as the only treatment method within SEZ

An alternative was considered where no mechanical equipment would be used in stream environment zones (SEZs). Treatment would consist of hand thinning and piling only. This alternative was dropped from further consideration because of forest health objectives, feasibility, safety and treatment needs for riparian vegetation:

- If mechanically treated stands with SEZs were to be hand thinned, a majority may not be thinned to the desired condition for forest health objectives due to the amount of trees greater than 14” dbh that could not be safely hand carried from within the SEZ no pile zone.
- If mechanically treated stands with SEZs were to be hand thinned, the length of time that the thinning treatment would be effective would be shortened. Stands would grow back to levels that exceed the desired stand density objective within 5 to 10 years as opposed to remaining at desired densities for 20 years or longer.
- If mechanically treated stands with SEZs were to be hand thinned, there is the potential that high levels of fuel loading within the no-pile buffer of the SEZ, would remain. With hand thinning, fuels would need to be moved out of this zone for piling manually. It would be difficult, costly, and unsafe to move all bole material greater than 14” diameter outside of the no-pile buffer. Fuels greater than 14” diameter may have to be left within the SEZ no-pile buffer which would likely exceed the desired maximum fuel load of 15 tons per acre.
- There is no environmental benefit to conducting hand thin operations within an SEZ as opposed to Cut-to-length/log forwarding harvest systems. Cut-to-length/log forwarding systems have been proven to be able to operate within SEZ areas with soil types similar to those within the Heavenly SEZ Demonstration Project with no adverse environmental affects.
- 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 20” 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.

Treatment using Cut-To-Length equipment only

An alternative was considered to use only CTL equipment for thinning trees in the mechanical treatment areas of the project. Whole tree thinning methods would not be used. 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 is because whole tree logging does not leave as much fuel on the ground as CTL because trees are processed at the landing instead of in the stand. Based on analysis presented in the document, WT methods have acceptable impacts to resources.

No removal of fuels in Wildlife Areas

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 (referred collectively in this EIS as Wildlife Areas). This alternative was dropped from further consideration because:

- The Wildlife Areas are distributed throughout the project area and account for almost 3,700 acres or 30% of the project area. To not implement treatments to reduce fuels on this much of the project area would leave substantial amounts of hazardous fuels in areas identified as needing fuel reduction. While treating the individual remaining stands would result approximately 2/3 of the project area meeting the desired condition, leaving approximately 1/3 of the area untreated would fail to meet the desired conditions over the landscape. The amount and distribution of untreated fuels in the Wildlife Areas would not reduce the potential for crown fires to an acceptable level. This would leave homes and the community vulnerable to wildfire. The purpose and need of the project would not be met.

Concentration of operations in only one area at a time

An alternative was considered that would schedule nearby mechanical treatment at the same time to improve operational 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 more of the HUC7 watersheds within the project analysis area to exceed 100% of their threshold of concern. This alternative could cause unnecessary risk for environmental harm and may not meet water quality standards.
- 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.

Establish a limit to the size of trees cut

Public comments received during scoping indicated a concern for removal of trees that exceeded various diameter limits; 12”, 14”, 16”, 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 comment 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 analyzed to respond to these comments and limit tree removal to 12" dbh or less. This alternative was dropped from further consideration for several reasons:

- The current stocking levels within the South Shore project are highly variable. While there are some stands in the South Shore project where the desired stocking level of 80 to 150 sq ft basal area per acre might be reached by only removing trees up to 12" (or incrementally larger diameter limits (e.g. 16") there are many stands where a diameter limit would leave too many trees and the stand would be over stocked, unhealthy and vulnerable to wildfire. 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. 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 competition and probability of tree mortality from lack of resources, disease and/or insect attack increases. In most units within the South Shore project few trees near 30" diameter would need removal to meet the desired stocking level. Using an absolute diameter limit in all stands 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 use of basal area as the target is a much better measure of a healthy stand than using diameter limits. 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.

- The use of diameter limits if imposed on roads and landings could prevent use of some existing openings as landings where the use of the area is in all other respects acceptable but for a few trees that would exceed the diameter limit. This could lead to additional disturbance to create new landings where diameter limits would allow or prevent the ability to create landings where needed which would result in treatment units (or portions of them) not being treated.
- Imposing a set diameter limit would prevent effective removal of encroaching conifers in SEZs and aspen stands, some conifers with diameters exceeding 12" need to be removed to release aspen stands and retard future conifer encroachment. Along some SEZs, some conifers over 12" dbh need to be removed in order to allow riparian vegetation to become dominant.
- One of the identified purposes is to reverse this historically created species distribution through retention of Jeffrey 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. 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 Lake Tahoe Basin and left a preponderance of less fire-resistant and less drought-tolerant white fir and lodgepole pine. One of the stated purposes of the South Shore project is to attain desired conditions of larger, widely spaced, more fire-resistant trees. See the Chapter 1 sections: Emphasis on Reducing Conifer Density and Treating Fuels; and Purpose and Need for Action.

Thinning trees and brush only in the Defensible Space zone within 200 feet of homes

An alternative was considered that would only thin trees and brush in the defensible space zone, offering this service to homeowners who wish to participate (thinning would occur on private land (for willing homeowners) and on public lands within 200 feet of homes). This alternative was dropped from further consideration for several reasons:

- Limiting fuels reduction and forest health treatments to within 200 feet of a home would reduce proposed treatments to less than 900 acres over the entire project area. This would result in almost 9,770 acres or 92% of the project area not being treated. To not implement treatments that reduce fuels on this much of the project area would leave substantial amounts of hazardous fuels in areas identified within the WUI as needing fuel reduction. In addition, the treatments implemented under this alternative would fail to meet the desired conditions over the landscape and have little to no effect on changing fire behavior across the landscape. While this alternative could improve defensible space to homes, it would leave homes and the community vulnerable to large wildfire events. The purpose and need of the project would not be met under this alternative.
- This alternative would not meet the need for restoration of forest health and restoration of SEZs including aspen stands in the South Shore area as described in the FEIS (Chapter 1 Purpose and Need For Action, items #2 and #3).
- Implementing fuels reduction treatments beyond the National Forest boundary on private or other ownerships is outside the scope of authority for the Forest Service and this project.

No treatment in areas greater than 1 ½ miles from residences

An alternative was considered that would eliminate treatments further than 1 ½ 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:

- Highway 89 was identified as an essential egress route by the Fallen Leaf and Lake Valley Fire Protection Districts, and the South Lake Tahoe Fire Department in their community wildfire protection plans (CWPPs). The HFRA requires that projects accomplished under HFRA authority be consistent with the CWPPs. Elimination of treatments along Highway 89 would fail to modify wildfire behavior along an identified egress route and would not be consistent with the CWPPs. .
- The Stewardship Fireshed Assessment (USDA FS LTBMU 2007) 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, neighborhoods, and critical infrastructure (transmission lines) 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.
- The project identifies objectives for both fuels reduction and restoring healthy forest conditions. In Chapter 1 it is stated under purpose and need that "there is a need for restoration of forest health in the South Shore area where stands of trees have become overly dense. Existing overcrowded stands have higher than average mortality which leads to ever-increasing fuel loads and high intensity wildfire risk which subjects them to widespread forest dieback from insects and diseases."
- As described in the proposed action (Chapter 1) the treatment area within the WUI is consistent with the Forest Plan. "Consistent with SNFPA (USDA FS 2004a, p. 40), in the project area, the

WUI boundaries were refined based upon site-specific topography and other features that provide logical fireline placement during suppression, such as slope breaks, roads, and streams."

Accomplishing fuels treatments and stream restoration activities at the same time

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:

- 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.
- The following restoration projects are currently under various stages of planning and implementation and would not meet the timing schedule for South Shore treatments:
    - Cold Creek/High Meadows – Project has been initiated under a separate NEPA decision completed in 2009.
    - Upper Truckee River – This is a joint project with the CA Tahoe Conservancy due to the presence of both state and federal lands in the project area, and could not be included in this project for that reason.
    - Angora Creek, Seneca Pond, and Gardner Mtn. Meadow – All were included in the NEPA decision for the Angora Fire Restoration Project due to their location within the Angora burn area.
    - 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.

Basing treatment on modelled condition of individual stands

An alternative was considered that would treat only units where fire behavior modeling for individual stands showed the unit 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.
- Stands where spacing and basal area meet the desired conditions, indicate healthy forest conditions, and that do not have unacceptable levels of hazardous fuels, are not proposed for treatment in the South Shore project.

Implementing Fuels Management direction contained in the 2001 SNFPA

An alternative was considered that would implement direction in the 2001 Sierra Nevada Forest Plan Amendment (SNFPA). This alternative would have a maximum 20” dbh limit for tree removal. The 2001 SNFPA also required retaining 10% to 20% of all stands in an untreated condition during hazardous fuel reduction treatments. This alternative was dropped from further consideration because:

- The LTBMU Forest Plan was amended by the 2004 SNFPA, which superseded the 2001 SNFPA.
- Limiting the diameter of trees cut to 20” dbh would not meet the purpose and need of this project. The rationale is described in detail above (“Limit the size of trees cut”).
- Retaining 10% to 20% of all stands in an untreated condition would in most areas not meet the purpose and need of the project at the stand level. The desired condition of the project is defined by the remaining basal area and tons per acre within the treated stands. The existing condition of stands within the South Shore Project area varies widely. Leaving 10% to 20% of the stands untreated would leave the landscape vulnerable to wildfire. In addition, the action alternatives propose to treat only about 15% of the total area within the Analysis Area, therefore much of the area will not be treated. The treatments are planned only for areas within the WUI. The forested lands outside the WUI will remain untreated.

Comparison of Alternatives

Table 2-5. 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 Uplands	4855	5823	968
Total Hand Treatment	4942	5961	1019
Cut to Length SEZ	447	385	-62
CTL Uplands	1463	1625	162
Total Cut-to-Length	1910	2010	100
Whole Tree with SEZ inclusions	198	170	-28
WT Uplands	3620	1971	-1649
Total Whole Tree	3818	2141	-1677
Total Mechanical Treatment	5728	4151	-1577
Total SEZ treatment	732	693	-39
Total Uplands	9938	9419	-519
Total treatment	10670	10112	-558

Table 2-6. Comparison of fuel treatment type acres by alternative

Fuel Treatment Type	Alternative 2 Acres	Alternative 3 Acres	Differences Acres
Lop & Scatter	2353	1616	-737
Landings – pile burning and/or removal	128	77	-51
Mastication/ Chipping	2480	2617	137
Pile and burn	4372	5217	845
Underburning (Lop & Scatter)	850	774	-76
Pile and burn (SEZs)	87	138	51
Lop & Scatter (SEZs)	198	170	-28
Underburning (SEZs)	32	28	-4

Table 2-7. 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	850	604	-246
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	1320	967	-353
Acres treated within goshawk TRPA Disturbance Zone	2554	2248	-306
Acres treated within bald eagle winter habitat	162	154	-8
Acres treated within osprey TRPA disturbance zone	567	541	-26
***** Due to spatial overlap, the change in acres is discrete for each row (not a cumulative total, by alternative).			

Table 2-8. Decrease in proposed road construction and landings between Alternatives 2 and 3

	Alternative 2	Alternative 3	Change (Decrease)
New temporary roads	4.8 mi	3.8 mi	- 1 mi
Existing temp roads	10.3 mi	8.6 mi	- 1.7 mi
Number of Landings	219 landings	168 landings	-51 landings

Table 2-9, beginning on the following page, provides a brief summary of the alternatives and their environmental consequences 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 2-9. Comparison of Environmental Consequences of Alternatives by Measurement Indicator

A. Fire Behavior and Fuels

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Condition Class	CC 1 – 1,230 CC 2 – 2,687 CC 3 – 6,753 Continuing shift to CC 3	CC 1 – 4,923 CC 2 – 5,747	CC 1 – 4,421 CC 2 – 5,691
Surface Fuel Load	27 tons/acre 8-66 tons/acre range	Surface fuel reduced to an average of 10-15 tons/acre on 10,670 acres	Surface fuel reduced to an average of 10-15 tons/acre on 10,112 acres
Fire Behavior - Fire Type (Acres)	Surface - 684 Passive Crown -6,578 Active Crown - 3,408 Crown fire not reduced	Surface - 8,831 Passive Crown- 1,424 Active Crown - 415 Crown fire reduced 89% on 10,670 acres	Surface - 8621 Passive Crown - 1,138 Active Crown - 353 Crown fire reduced 89% on 10,112 acres
Fire Intensity - Flame Length (Acres)	Less than 4' - 2,424 4' to 8' – 1,914 Greater than 8' – 6,332	Less than 4' – 9,332 4' to 8' – 363 Greater than 8' - 975	Less than 4' – 8,932 4' to 8' – 426 Greater than 8' - 754

B. Forest Vegetation			
Measurement Indicator	**Alternative 1** **No Action**	**Alternative 2** **Proposed Action**	**Alternative 3** **Preferred Alternative**
Stand Composition and Structure	Higher levels of understory shade tolerant species	Higher levels of large, widely spaced, shade intolerant species	Higher levels of large, widely spaced, shade intolerant species
Density – Basal Area (ft^2/acre)	Currently: 200 20 Years: 255	Post Treat:147 20 Years: 195	Post Treat:142 20 Years: 191
Density - Stand Density Index (% Max SDI)	Currently: 84% 20 Years: 99%	Post Treat: 48% 20 Years: 61%	Post Treat: 48% 20 Years: 62%
Forest Health - Dwarf Mistletoe (DMI)	Currently: 3.5 20 Years: 4.2	Post Treat: 0.8 20 Years: 1.0	Post Treat: 0.8 20 Years: 1.0
Forest Health – Insect Related Mortality Risk (% acres $\geq$60% Max SDI)	Currently: 65% 20 Years: 78%	Post Treat: 33% 20 Years: 47%	Post Treat: 35% 20 Years: 53%

C. Geology and Soil Resources

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Geologic Hazards	Insignificant potential for geologic hazards; increased potential for mass movement with severe wildfire.	Insignificant potential for geologic hazards	Insignificant potential for geologic hazards
Soil Porosity and Hydrologic Function	No change; potential for slight reduction of porosity and extensive, short-term reductions in hydrologic function with severe wildfire.	Extent and magnitude of reductions would be minor and mostly long-term.	Extent and magnitude of reductions would be slightly less than Alternative 2; duration would be similar.
Effective Soil Cover	No change; with severe wildfire significant short term losses are possible over an extensive area.	Minor losses; not of an extent or magnitude that would significantly affect productivity; short term duration.	Impacts slightly less than Alternative 2; duration would be similar.
Surface and Subsurface Organic Matter	No change; potential for significant short term loss of surface organic matter and minor loss of subsurface organic matter with severe wildfire.	Minor losses; not of an extent or magnitude that would significantly affect productivity; short term duration.	Impacts slightly less than Alternative 2; duration would be similar.
Severe Burning	No change; potential for significant impacts with severe wildfire; extent would depend on fire size.	Extent of impacts would be minor and would not significantly affect productivity.	Extent of impacts would be slightly less than Alternative 2.

D. Water and Riparian Resources

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Watershed Condition	No change, high risk for future high intensity wildfire.	Reduced risk of future high intensity wildfire.	Reduced risk of future high intensity wildfire.
Stream Channel Condition	No change, 3 existing stream crossings that act as fish passage and/or sediment conveyance barriers would remain in place.	Positive effect from replacing 3 failing stream crossings with improved crossings. Project related impacts would be minor and mitigated with stream buffers and crossing installation and removal RPMs.	The 3 failing existing crossings would be replaced, and lesser other impacts would occur than with Alternative 2 because of reduced treatment acres in SEZs.
Water Quality and Beneficial Uses	No change, greater potential for water quality effects from possible future high intensity wildfire.	Sediment delivery resulting from project treatments would not be measurable above background levels with application of BMPs and project specific RPMs.	Lesser potential impacts than with Alternative 2 would result because of reduced acres of WT mechanical treatment and fewer acres of SEZ treatments.
SEZs, Floodplains, and Aspen Stands	No change, conifer encroachment will continue to compete with riparian vegetation for water and nutrients in these areas.	Effects will be minimal and short term due to soil moisture requirements for mechanical treatments, piling restrictions, and proposed adaptive management.	Effects will be slightly less than those for Alternative 2 due to fewer acres of SEZ treatment proposed.

E. Aquatic Wildlife

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Stream shade and water temperature	Not expected to change from current levels	Short-term decrease of shade with long-term increase as larger tree structure develops. No measurable increase in stream temperature.	Short-term decrease of shade, but less than Alt. 2. No measurable increase in stream temperature.
Coarse Woody Debris (CWD)	Amount of CWD will increase in the long-term.	CWD is left within stream channels per RPAs.	CWD is left within stream channels per RPAs.
Sediment	No change from current levels.	Potential increase resulting from roads and landings, but not measurable when considering background levels.	Potential increase resulting from roads and landings, but not measurable when considering background levels. Potential for sedimentation to streams is less than Alternative 2.
Lahontan Cutthroat Trout	No Effect	May Affect, but is not Likely to Adversely Affect	May Affect, but is not Likely to Adversely Affect
Known to Occur in Project Area: Lahontan Tui Chub & Great Basin Rams Horn	No Effect	No Effect	No Effect
Does Not Occur in Project Area: Sierra Nevada Yellow-legged Frog, Delta Smelt, Yosemite Toad, Northern Leopard Frog	No Effect	No Effect	No Effect

F. Terrestrial Wildlife

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Effects to Fisher and Sierra Nevada Red Fox	No Effect	No Effect	No Effect
Effects to Wolverine	No Effect	Disturbance; fine scale habitat fragmentation; reduced risk of course scale habitat fragmentation; <4% resting and foraging habitat affected; no change in acres of denning, resting, and foraging habitat.	Disturbance; fine scale habitat fragmentation; reduced risk of course scale habitat fragmentation; <4% resting and foraging habitat affected; No change in acres of denning, resting, and foraging habitat.
Effects to American Marten	No Effect	Disturbance; fine scale habitat fragmentation; reduced risk of course scale habitat fragmentation; reduction of 1,204 acres of denning habitat; reduction of 755 acres of resting habitat; reduction in 653 acres of foraging habitat.	Disturbance; fine scale habitat fragmentation, reduced risk of course scale habitat fragmentation; reduction of 948 acres of denning habitat; reduction of 522 acres of resting habitat; reduction of 419 acres of foraging habitat.
Effects to Townsend's Big-eared Bat	No Effect	Disturbance; removal of some tree hollow-type roosts; if existing	Disturbance; removal of some tree hollow-type roosts; if existing
Effects to Bald Eagle	No Effect	Disturbance; addition of 91 acres of nesting habitat; addition of 24 acres of perching a habitat; addition of 180 acres of foraging habitat.	Disturbance; addition of 32 acres of nesting habitat; addition of 24 acres of perching habitat; addition of 185 acres of foraging habitat.

F. Terrestrial Wildlife, Cont.

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Effects to Northern Goshawk	No Effect	Disturbance; Initial reduction in suitable habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories; reduction of 3,124 acres of nesting habitat; reduction of 42 acres of perching habitat; addition of 3 acres of foraging habitat.	Disturbance; Initial reduction in suitable habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories; reduction of 2,828 acres of nesting habitat; reduction of 50 acres of perching habitat; addition of 2 acres of foraging habitat.
Effects to California Spotted Owl	No Effect	Disturbance; Initial reduction in suitable habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories; reduction of 1,613 acres of nesting habitat; reduction of 1,675 acres of roosting habitat; reduction of 1,366 acres of foraging habitat.	Disturbance; initial reduction in suitable habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories; reduction of 1,356 acres of nesting habitat; reduction of 1,418 acres of roosting habitat; reduction of 1,281 acres of foraging habitat.
Effects to Great Gray Owl	No Effect	Disturbance; conifer encroachment in meadows reduced; reduction of 2,103 acres of nesting, roosting, and foraging habitat.	Disturbance; conifer encroachment in meadows reduced; reduction of 1,798 acres of nesting, roosting, and foraging habitat.
Effects to Willow Flycatcher	No Effect	Disturbance; Possible long term increase in deciduous, riparian shrubs; approximately 4% of suitable nesting, perching, and foraging habitats affected	Disturbance; Possible long term increase in deciduous, riparian shrubs; approximately 3% of suitable nesting, perching, and foraging habitats affected

G. TRPA Special Interest Species

Species	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Northern Goshawk	No Effect	Disturbance; Initial reduction in suitable habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories	Disturbance; Initial reduction in suitable habitats would be followed by growth of treated stands along trajectories more beneficial than current trajectories
Osprey	No Effect	Disturbance; Stand condition in the disturbance zone are expected to be enhanced	Disturbance; Stand condition in the disturbance zone are expected to be enhanced
Bald Eagle (winter)	No Effect	Disturbance; slight increase in nesting, perching, and foraging habitat	Disturbance; slight increase in nesting, perching, and foraging habitat
Bald Eagle (nesting) and Golden Eagle	No Effect	No Effect	No Effect
Peregrine Falcon	No Effect	Disturbance	Disturbance
Waterfowl	No Effect	Disturbance; habitat would be improved where treatments remove encroaching conifers	Disturbance; habitat would be improved where treatments remove encroaching conifers
Mule Deer	No Effect	Disturbance; short term reduction of forage and cover; long term increase in habitat quality	Disturbance; short term reduction of forage and cover; long term increase in habitat quality
Lahontan Cutthroat Trout	Are fish species present (or suspected)?		
	Yes – LCT are known to occur in the Upper Truckee River above Christmas Valley (upper limit of the South Shore Project area).		
	Is there an adjacent Lahontan cutthroat trout population which could be affected by the project?		
	Yes – Individual LCT could migrate into the project area before implementation occurs.		

H. Management Indicator Species			
MIS Habitat Factor	**Alternative 1 No Action**	**Alternative 2 Proposed Action**	**Alternative 3 Preferred Alternative**
Riparian Habitat: Change in Deciduous Canopy Cover	0	496 acres enhanced by reduction of understory conifers	466 acres enhanced by reduction of understory conifers
Riparian Habitat: Change in Total Canopy Cover	0	240 acres may show a reduction in total canopy cover by at least one size class.	176 acres may show a reduction in total canopy cover by at least one size class.
Riparian Habitat: Change in CWHR Size Class	0	179 acres expected to increase by at least one CWHR size class	140 acres expected to increase by at least one CWHR size class
Early and Mid Seral Coniferous Forest Habitat: Changes in CWHR tree size class	0	600 acres converted from CWHR size class 4 to size class 5	467 acres converted from CWHR size class 4 to size class 5
Early and Mid Seral Coniferous Forest Habitat: Changes in Tree Canopy Closure	0	1,728 acres reduced by at least one canopy cover class	1,538 acres reduced by at least one canopy cover class
Early and Mid Seral Coniferous Forest Habitat: Changes in Understory Shrub Canopy Closure	0	689 acres	631 acres
Late Seral Open Canopy Coniferous Forest Habitat: Changes in Tree Canopy Closure Class	0	12 acres reduced from closure class P to closure class S	12 acres reduced from closure class P to closure class S

H. Management Indicator Species, Cont.			
MIS Habitat Factor	**Alternative 1 No Action**	**Alternative 2 Proposed Action**	**Alternative 3 Preferred Alternative**
Late Seral Open Canopy Coniferous Forest Habitat: Changes in Understory Shrub Canopy Closure Class	0	51 acres	47 acres
Late Seral Closed Canopy Coniferous Forest Habitat: Change in Canopy Closure	0	70 acres reduced from dense to moderate	70 acres reduced from dense to moderate
Late Seral Closed Canopy Coniferous Forest Habitat: Change in Large Down Logs or Large Snags	0	Logs reduced to a minimum of 10 tons/acre on 31 acres; hazard snags greater than 30 inches dbh removed	Logs reduced to a minimum of 10 tons/acre on 20 acres; hazard snags greater than 30 inches dbh removed
Snags in Green Forest: Medium Snags per Acre	0	Medium snags reduced to below 3 per acre in the absence of larger sized snags, and not below 2 snags per acre in the presence of larger snags on 5,517 acres	Medium snags reduced to below 3 per acre in the absence of larger sized snags, and not below 2 snags per acre in the presence of larger snags on 5,376 acres.
Snags in Green Forest: Large Snags per Acre	0	Only hazard trees adjacent to established infrastructure and greater than 30 inches dbh would be removed	Only hazard trees adjacent to established infrastructure and greater than 30 inches dbh would be removed
Snags in Burned Forest Ecosystem Component: Medium Snags per Acre	0	Medium snags reduced to below 3 per acre in the absence of larger sized snags, and not below 2 snags per acre in the presence of larger snags on 315 acres.	Medium snags reduced to below 3 per acre in the absence of larger sized snags, and not below 2 snags per acre in the presence of larger snags on 315 acres

H. Management Indicator Species, Cont.

MIS Habitat Factor	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Snags in Burned Forest Ecosystem Component: Large Snags per Acre	0	Only hazard trees adjacent to established infrastructure and greater than 30 inches dbh would be removed	Only hazard trees adjacent to established infrastructure and greater than 30 inches dbh would be removed

I. Sensitive Plants

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Habitat Cover for Sensitive Plants	No change. Long term reduction possible from increased fuel loadings and potential wildfire event	No change. Long term improvement as a result of reduced fuel loading and conifer density	Same as Alt 2.

J. Noxious Weeds

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Risk of Noxious Weed Invasion	No short term increase. Long term potential increase in risk due to increased wildfire risk	Localized minor increase in risk within mechanical treatment, roads, and prescribed burn areas.	Same as Alt 2 but on fewer acres

K. Air Quality

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Fugitive Dust	No measureable increase from current levels.	Short term, temporary increase in fugitive dust from equipment hauling and thinning activities. Minimal amounts due to use of BMP and Resource Protection Measure mitigations.	Short term, temporary increase in fugitive dust from equipment hauling and thinning activities Fewer acres of mechanical treatments leading to dust production as compared to alternative 2. Minimal amounts.
Smoke Emissions (particulate matter)	No increase in smoke particulate matter from current levels. Increased potential large release of particulate matter as a result of wildfire	Smoke particulate matter increased from prescribed burning activities. Within standards for emissions. Substantially reduces emission potential from wildfire.	Increased acres of prescribed burning activities. Negligible increase in particulate matter compared to Alternative 2. Within standards for emissions

L. Heritage Resources

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Effect to Heritage Resources	No direct impacts, but continued long term risk to cultural resources from wildfire in areas with heavy fuel loads.	Reduction of risk to cultural resources from high intensity wildland fires.	Reduction of risk to cultural resources from high intensity wildland fires, but with less acreage treated.
Reduction of Conifers in Aspen Stands	No direct impacts, but continued long term risk to arborglyphs from wildfire and conifer competition (which can threaten the health of aspens with arborglyphs.)	Protection of arborglyphs in aspen stands while reducing wildfire hazards and conifer competition. Increase health and longevity of carved trees.	Protection of arborglyphs in aspen stands while reducing wildfire hazards and conifer competition, but with less acreage treated. Increase health and longevity of carved trees.

M. Scenic Resources			
Measurement Indicator	**Alternative 1 No Action**	**Alternative 2 Proposed Action**	**Alternative 3 Preferred Alternative**
Meeting visual quality objectives (VQOs)	Consistent with VQO	Consistent with VQO. Short term deviation during and immediately after treatments	Consistent with VQO. Short term deviation during and immediately after treatments
Scenic stability	Low	High stability in treatment areas	High stability in treatment areas

N. Recreation			
Measurement Indicator	**Alternative 1 No Action**	**Alternative 2 Proposed Action**	**Alternative 3 Preferred Alternative**
User Created Trails	No affect to the current use patterns	Use patterns are likely to remain consistent with current conditions	Use patterns are likely to remain consistent with current conditions
Access Restrictions	No affect to the current use patterns	Short term public recreation restrictions as areas are closed during implementation for public protection	Fewer short term public recreation restrictions as areas are closed during implementation for public protection compared to Alt 2
Christmas Tree Program	No affect to the current use patterns	Short term reduction in opportunities as treatments are implemented	Short term reduction in opportunities as treatments are implemented
Recreation Experience (ROS)	No affect to the current use patterns	Short term negative affect to recreation visitor experience, no change to the ROS class	Short term negative affect to recreation visitor experience, no change to the ROS class

O. Transportation and Access (Roads)

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Change in Access	No change	Minor reconstruction and maintenance to current access. No permanent change in access.	Same as Alternative 2

P. Economics

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Present Net Value	$0	$-3,334,000	$-8,674,000

Q. Special Designated Areas

Measurement Indicator	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Preferred Alternative
Effect to Wilderness	No effect to wilderness	No effect to wilderness	No effect to wilderness
Change to Roadless Character	No change to roadless character	Minimal hand and mechanical treatment adjacent to homes and highways. No change to roadless character.	Minimal hand and mechanical treatment adjacent to homes and highways. No change to roadless character.

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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.

Changes from DEIS to FEIS

As a result of public comments on the DEIS, review by the IDT, and lessons learned on other project NEPA documents, each section of Chapter 3 has been edited to improve clarity. The editing was largely in format and presentation. Overall the environmental consequences and conclusions are the same as presented in the DEIS. The editing of Chapter 3 did not result in any change in the disclosed environmental consequences of any resource. Where typos, errors, or unclear language was noted, it has been corrected. The indicators of effect have been consolidated into one part at the beginning of each resource section. In the DEIS they were presented somewhat differently in each section. The cumulative effects part of each section has been edited to be more consistent and focused on the cumulative effects as defined by NEPA. There are slight variations in acreage calculations in Chapter 2 and 3 due to such things rounding, differences in the models used to predict resource conditions, slight variations in geographic information system (GIS) mapping data, etc. These slight variations are minor and inconsequential to the effects analysis.

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 resource areas. The discussion of alternatives is organized by resource area and presented in the following order:

Scope of the Analysis and Indicators of Effect

This section introduces each resource area with the background for the area of consideration used in the analysis that follows. Each resource may have different areas of consideration. For example certain species of wildlife may range outside the watersheds included in the project while a plant species may only be limited to a few locations. The indicators of effect are the descriptions of the metrics that are used to describe the differences between alternatives. They provide the basis for the analysis of environmental consequences and describing the differences between alternatives. They may be qualitative, quantitative or a mixture of both depending on the resource.

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 of implementing each of the alternatives to the resource area, 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

A cumulative effect is the effect on the environment that 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. An individual action when considered alone may not have a significant effect, but when its effects are considered in sum with the effects of other past, present, and reasonably foreseeable future actions, the effects may be significant.(40 CFR 1508.7, 1508.8). Cumulative effects can result from individually minor, but collectively significant actions, taking place over a period of time. Appendix A summarized the environmental consequences of past, present, and future projects within the project area, and reference Map 6 for location of the projects.

Cumulative effects are commonly confused with indirect effects. The cumulative effects analysis for each resource takes a look at the other past, present and foreseeable future actions: by the Forest Service as well as other agencies.

- *Cumulative effects*, generally speaking, are those additive effects to resources on the landscape from:
    1) the actions proposed in the South Shore project (as an additive effect) when combined with
    2) the lingering effects of:
        a) past projects,
        b) currently active projects, and
        c) projects that are planned in the foreseeable future.

  To accomplish this, it is necessary to establish analysis boundaries in time and geographic area.

    - This analysis relies on *current environmental conditions* as a proxy for the *impacts of past actions*.
        - This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment (and might contribute to cumulative effects).

While some of the recent past actions are identified and summarized in Appendix A, the cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach.

1) A catalog and analysis of all past actions would be impractical to compile – and unduly costly to obtain. Current conditions within the project area have been impacted by

innumerable actions over the last century (and longer); attempting to isolate the individual actions that continue to have residual impacts would be nearly impossible.

2) Providing the details of past actions, on an individual basis, would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions can risk ignoring the important residual effects of past natural events, which also contribute to cumulative effects by looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects.

3) Public scoping for this project did not identify any public interest or need for detailed information on individual past actions.

4) The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.” (Connaughton 2005)

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

> “CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)”

The *reasonably foreseeable future actions* used in the cumulative analysis are limited to projects that are funded and have progressed in the planning stages sufficiently to clearly identify the anticipated direct and indirect environmental effects. Projects where the implementation may take place at some undefined point in the future and/or have unformed proposed actions which do not yet have specific environmental consequences cannot be reasonably included in the analysis.

Stated simply, if the specific location, action, direct and indirect effects, and timing cannot be predicted with some degree of certainty, then including that project in the analysis is only speculative – which may lead to inaccurate cumulative effects analyses Future actions are only included if their impacts are forecasted to occur before the impacts of the proposed action have ended.

Analytical Conclusions

The Analytical Conclusions section is provided at the end of each resource section within chapter 3 of the the FEIS to provide a brief summary of the analysis and to clarify the conclusions of the environmental effects analysis for each resource. Based on the analysis, this section presents the determination of whether or not there are *significant* environmental impacts.

Required Federal Considerations and Disclosures

Chapter 3 of the FEIS concludes with Environmental Justice findings, a summary disclosure of the Short Term Uses and Long Term Productivity, Irreversible and Irretrievable Commitment of Resources, and Unavoidable Adverse Effects.

Fire Behavior and Fuels

Scope of the Analysis and Indicators of Effect

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. Stands with prior fuel treatments experienced lower wildfire severity than untreated stands burning under the same weather and topographic conditions (DeBano et al 1998; Safford et al 2009). Topography and weather at a given location are beyond the ability of management to control. Fuel hazard is the only controllable factor.

At issue is the risk for high intensity, high severity catastrophic wildfire within the project area 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.

Indicators

For purposes of this analysis, the following indicators of fire behavior, fuels and ecosystem components were discussed for each alternative: surface fuel loading, and fire behavior which will be characterized by fire type and fire intensity. In addition, condition class will be utilized as indicator of ecosystem components.

Surface Fuel Loading

Surface fuels consist of down logs, limbs, needles, and shrubs and contribute to fire behavior, severity, and suppression capabilities. Surface fuels are measured in tons per acre by size class of *dead fuels*: 1-hour fuels at 0-1/4”, 10-hour fuels at ¼-1”, 100-hour fuels at 1-3”, and 1000-hour fuels that are 3” and larger. The smaller diameter fuels tend to be a greater factor in fire intensity contributing to flame lengths and rate of spread. Fire persistence, resistance-to-control, *fireline intensity* (also known as Byrams fireline intensity or frontal fire intensity, is the rate of heat energy released per unit time per unit length of fire front, regardless of the depth of the flame zone [Byram 1959]) and burnout time (which effects soil heating) are significantly influenced by surface fuel loading, and the size and decay state of larger diameter fuels (Brown et al 2003). Surface fuels greater than 3 inches also contribute towards fireline intensity, resistance to control, and spotting, but they are not used in the fire behavior-modeling algorithm.

Fuel models (Anderson 1982) are used to estimate fire behavior and are applied when using fire behavior models and as a tool for determining fuels treatments. Stands that have representative fuel models with fuel loads that are less than 6 tons per acre in the 0” to 3.0” size classes tend to have a surface fire type of fire behavior with low to moderate torching. Other stand characteristics determine fire behavior as well and are discussed below.

The alternatives will be evaluated in how the average fuel loading is reduced, over the project area, (measured in tons per acre) in relationship to the desired condition. The desired surface fuel loads for the project area would be a maximum of 10 tons/acre with the majority (approximately 6 tons/acre) in larger diameter classes (18” and greater). In areas where stream zones or wildlife habitat require a higher component of large down wood, a maximum of 15 tons per acre is acceptable. The desired fuel loads of 10 tons per acre is based on having up to approximately 4 tons per acre in the 0” to 3.0” size classes and allowing for approximately 6 tons of larger down logs per acre..

Fire Behavior

Fire behavior indicators that are used to measure fire characteristics are: rate of spread, fire type, fireline intensity, energy release component and flame length.

There are two characteristics that measure both treatment effectiveness and the environmental effects of the alternatives at the landscape level, they are:

- Predicted fire type, and
- Fire intensity.

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 four categories:

- Ground fuels, which are composed of forest fuels that lie below the litter layer or within the soil, including organic soils, forest floor duff, decomposing woody material.
- 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 provide contact from the surface fuels to the lower crowns of overstory trees.
- Canopy fuels are the live and dead material in the crowns of trees (Petersen et al 2003)

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: surface fuels, crown base height, and crown bulk density.

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. Surface fuels are coarse 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.

Crown base height (CBH) and crown bulk density (CBD) are two critical factors in predicting crown fire propagation and spread.

- Crown base height (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 (CBD) 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).
  - CBD 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 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 CBD 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

The fire models for the South Shore project generated three expected fire types over the entire landscape, modeled for each alternative:

- **Surface fire** burns loose debris on the surface, which includes dead branches, leaves, and low vegetation. Surface fire types are generally considered to be non-lethal although smoldering activity in deep duff layers or in large down fuels may 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, long range spotting (up to a ¼ mile) can also occur. Active crown fires are considered lethal.

The desired condition is to manage for surface fire and to reduce the amount of the landscape where passive and active crown fire might occur.

- The effectiveness of the alternatives are evaluated by the magnitude that the proposed treatments shift the project area towards a surface fire type and away from active crown fire type.

Fire Intensity

A measure of surface fire intensity is flame length. Flame length is the average distance (in feet) from the fire's surface to the top of a flame. It can be modeled based on the kind, amount and arrangement of fuels. 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 a fire. Flame lengths less than 4 feet can usually be attacked successfully (with hand tools and hand constructed fire line). 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 feet. 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 spread most rapidly, typically from 10:00 am to sunset). Higher flame lengths indicate greater fire intensity.

- Based on these considerations the desired maximum flame lengths for the project area is 4 feet or less.
- The alternatives are evaluated on how well they manage the fuels to achieve this desired condition.

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, including: fire suppression, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), and other past management activities. Losses of key ecosystem components increases as the departure from the historic conditions increases, with little or no risk at the Condition Class 1 level and a high risk for loss of key ecosystem components at Condition Class 3. The alternatives are evaluated based on effectiveness of the proposed treatments in shifting the existing Condition Class to the desired level of Condition Class – 1 or 2.

Methodology

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 both 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.

The Meyers remote automated weather station (RAWS), located within the project area at the Meyers Fire Station, was selected to obtain 90^{th} percentile weather data for use in fire behavior modeling. The 90^{th} percentile weather represents the “average worst” weather conditions for days when fires occur in a typical fire season. These conditions would be in effect on 10 percent of all the days that large fires occur on the LTBMU. The 90^{th} percentile fire weather indices were obtained from station recordings dating back to 1970. Table 3-1 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 3-1. 90th Percentile Fire Weather Data for Meyers, California

Fuel/Weather Variable	90th Percentile Values
1 Hour Fuel Moisture, %	3
10 Hour Fuel Moisture, %	5
100 Hour Fuel Moisture, %	6
1000 Hour Fuel Moisture, %	13
Herbaceous Fuel Moisture, %	80
Woody Fuel Moisture, %	80
20 Foot Wind Speed, MPH	25
Dry Bulb Temperature, Degrees F	85
Source: Meyers Remote Automated Weather Station	

Fire Behavior Modeling

Fire behavior models are an integral part of this analysis due to the amount and locations of the proposed treatment acres on the landscape. As with all models, fire behavior models have assumptions and limitations to their use. Below is a list of fire behavior and fuels models utilized for this analysis:

Farsite is a fire behavior and fire growth simulator that incorporates both spatial and temporal information on topography, fuels, and weather.

Fire Behavior Fuel Models are used to estimate fire behavior and are applied when using fire behavior models and as a tool for determining fuels treatments (Anderson 1982).

FireFamily Plus is used for analysis of fire danger indices and weather.

Flammap is a fire behavior mapping and analysis program that computes potential fire behavior characteristics (spread rate, flame length, fireline intensity, etc.) over an entire FARSITE landscape for constant weather and fuel moisture conditions.

Fire Regime Condition Class (FRCC) is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels and disturbance regimes.

Fuels Management Analyst Plus (FMA+) is suite of programs for use by resource managers to inventory and estimate surface and canopy fuel loading

Forest Vegetation Simulator, Fire Fuels Extension (FVS FFE) is a forest growth model which is widely used by forest managers and the research community to provide predictions of how the primary vegetation in forests will change over time (Crookston and Dixon 2005). FFE-links the dynamics of forest vegetation (primarily trees) with models of snag, fuels, and fire behavior.

Stand-level Modeling

Individual stand inventory data from the project area informed current condition information. Posttreatment 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 outcomes of forest stand conditions prescribed treatments. The effects of the proposed treatments are based on FVS projections of stands with inventory data that are representative of average stand conditions. Individual treatment stands were then modeled using FVS and the fire and fuels extension (FFE) of FVS to project fire behavior and effects of individual stands for all three alternatives. The predicted fire behavior is based on severe conditions represented by the 90^{th} percentile weather conditions. The variables to predict fire activity include: fuel model, stand density including both live and dead trees, tree species, CBD, crown height, and fuel loads. Fuels data collection (for use in the FVS/FFE program) was conducted with the use of photo series interpretation (USDA FS 1981). Photo series interpretation instead of hard sampling measures allows for a higher degree of variability and lesser degree of accuracy when determining fuel loading.

Landscape-level Modeling

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 point in 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 within FlamMap application, or exported for use in a GIS, as an image file, or a word processor document. 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, and Nelson's 2000 dead fuel moisture model.

FMAPlus was utilized to estimate crown bulk density and crown base heights these estimates were then plugged into the Farsite landscape and run in FVS,

Existing Conditions – Fire Behavior and Fuels

The following section discusses the current status of each of the indicators.

Condition Class

The *fire return interval* (FRI) within the project area ranges between 5-32 years (Murphy and Knopp 2000). Fires occurring as a result of Native American burning prior to settlement along with natural ignitions 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). When determining Condition Class for the project area as a landscape, the relatively low acres of fire, wildfire or prescribed, that has occurred in the past results in an overall rating for all forest types as a Condition Class 3.

At a stand level for the proposed treatment area, the Condition Class is based more on the condition of the stand (canopy cover, stand density, etc) versus the fire history. At a stand level, approximately 1,230 acres proposed for treatment are considered to be in Condition Class 1; 2,687 acres in Condition Class 2; and 6,753 acres in Condition Class 3.

Figures 10 through 13 are photos representative of forest 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).

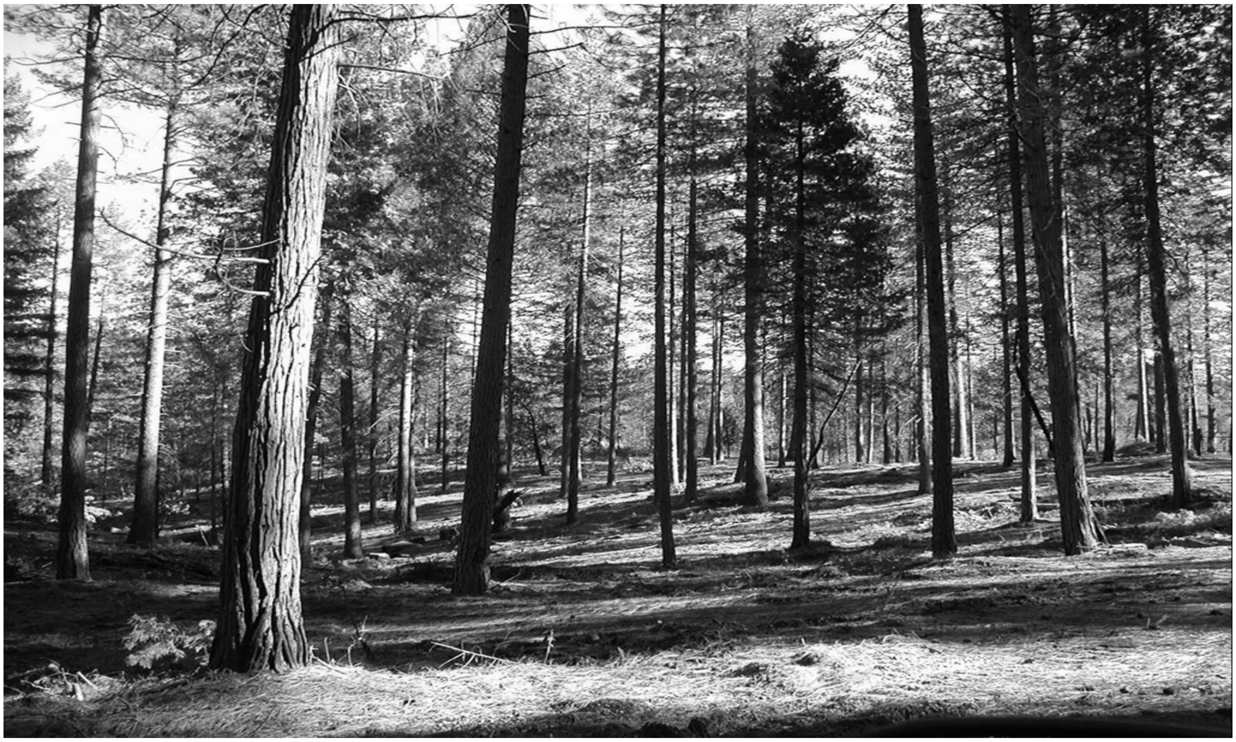

Figure 10. Condition Class 1 in Mixed Conifer within the South Shore Project Area

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 10 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 11 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 in Figures 12 and 13 are of stands within the project area that exhibit the characteristics of condition class 3 in the mixed conifer vegetation type.

Figure 11. Condition Class 2 in Mixed Conifer within the South Shore Project Area

Figure 12. Condition Class 3 in Mixed Conifer within the South Shore Project Area

Figure 13. Condition Class 3 in Mixed Conifer within the South Shore Project Area

Surface Fuel Loading

Total surface fuel loading for the project area ranges between approximately 8 to 66 tons per acre. Surface fuels in the 0 to 3 inch size class range from moderate to heavy (Table 3-2). In some areas dead and down fuel accumulations are as high as 80 tons per acre. Surface fuels greater than 3 inches are at approximately 18 tons per acre, contributing towards increased wildfire intensity, and resistance to control and spotting. The overall average is approximately 24 tons per acre.

Table 3-2. Average Fuel Loads

Size Class	Tons per Acre
0-1/4" (1 hour fuels)	1. 0
1/4-1" (10 hour fuels)	2.0
1-3" (100 hour fuels)	3.0
3+ " (1000 hour fuels)	18.0
TOTAL tons/acre	24.0

Fire Behavior

Existing fuel conditions are highly variable, with large areas of hazardous fuel accumulation, especially within the wildland-urban intermix (WUI).

The majority of stands proposed for treatment are moderately- to densely-stocked, with crown closures greater that 50%. These stands are overstocked with sapling and pole sized trees (3 to 24 inches dbh), however they are also 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 pine/ ponderosa pine) throughout the project area. This invasion has created hazardous ladder fuel conditions (where saplings from the forest floor have grown tall enough into the tolerant species canopy to allow flames on the ground to rapidly transition to igniting the crowns of trees), increasing the potential for crown fire spread.

Fire Type

CBH across the project area currently ranges between 0 to 9 feet. The current CBH range is considered hazardous because tree crown bases are near the ground and are likely to be in contact with other existing vegetation. CBD 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.

Resulting predicted fire types for the proposed treatment area under current conditions includes 4% that would be considered a surface fire type (Table 3-3).

Table 3-3. Alternative 1: Modeled Fire Type Results Under Existing Conditions

Category	Acres modeled	Percentage of Acres
Surface	684	4%
Passive Crown	6,578	63%
Active Crown	3,408	33%
TOTAL	10,670	100%

Fire Intensity –Flame Length

Under current conditions, approximately 22% of the project area is expected to burn with flame lengths less than 4 feet; approximately 18% is expected to burn with flame lengths between 4 and 8 feet; and approximately 60% is expected to burn at flame lengths greater than 8 feet. (Table 3-4).

Table 3-4. Alternative 1: Flame Length Under Current Conditions

Category	Acres modeled	Percentage of Acres
Less than 4 feet	2,424	22%
4 to 8 feet	1,914	18%
Greater than 8 feet	6,332	60%
TOTAL	10,670	100%

Environmental Consequences – Fire Behavior and Fuels

The following section discusses the direct and indirect environmental consequences of each of the alternatives.

Direct and Indirect

Alternative 1 – No Action

Under the No Action alternative, fuel would continue to accumulate. The expected outcome could be illustrated – given similar weather conditions – by the effects of the 2007 Angora Fire (on areas that had not received fuels treatments) (Murphy et al 2007).

Both surface and ladder fuels would continue to increase, which would therefore increase the risk of a high intensity fire. The existing dense canopy currently has high crown bulk densities (which can sustain an active crown fire). 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 growth of trees which are shade tolerant but not fire tolerant. As understory 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 that a wildfire would result in a stand replacement event.

Condition Class

Across the project landscape, Condition Classes would remain in Condition Class 3 as previously described in the Existing Condition Section.

At a stand level for the proposed treatment area, it is expected that the departure from historical range would continue to increase towards Condition Class 3 with proportional decrease of areas in Condition Class 1 and 2.

Surface Fuel Loading

With the No Action alternative, there would be an increase in stand densities resulting in less growth and vigor and an increase in mortality. Over time, the increase in stand densities would contribute to a continued increase in surface fuel loads within the stands. In ten years it is expected that the surface fuel loads would average about 27 tons per acre and up to 35 tons per acre in 20 years (Table 3-5). The desired maximum of 10 tons per acre would not be met over the project area. This would ultimately result in greater risk of an active crown fire if a wildfire were to occur. The increase in surface fuels greater than 3 inches would contribute towards fireline intensity, resistance to control, and spotting.

Table 3-5. Current and Future Predicted Surface Fuel Loading: Alternative 1 (No Action)

Current Ave Total Fuel Loads (tons/acre)	10 Years – Ave Total Fuel Loads (tons/acre)	20 Years – Ave Total Fuel Loads (tons/acre)
24	27	35

Fire Behavior

Fire Type

With no treatment, there would be an increase in stand densities, resulting in less growth and vigor, and an increase in mortality. Fire types currently predicted under severe conditions would depart from the existing conditions over time. The type of change would be based on factors such as increased fuel loads, CBD, CBH, stand densities, and mortality. Over time it is expected that the fire types would be less likely to be a low-intensity surface fire and more likely to be either a passive or active crown fire. It is expected that areas currently predicted to be a passive crown fire type would change to be an active crown fire type. Fire hazard in the area would become more severe and the potential for large, difficult to control fires would increase. This condition would reduce opportunities for direct fire line attack allowing fires to become considerably larger and potentially more hazardous for firefighters and the communities at risk (Table 3-3).

Fire Intensity –Flame Length

Currently, approximately 22% of the proposed treatment area is expected to burn at desired flame lengths of less than 4 feet (Table 3-4). With the no action alternative, it is expected that over time the area where flame lengths are currently forecasted to be less than four feet would be reduced; consequently, flame lengths would be greater than four feet, increasing the difficulty for suppression activities if a wildland fire were to occur.

Alternative 2 – Proposed Action

Implementation of Alternative 2 would result in the reduction of surface fuel on 10,670 areas. Stand density would be reduced, and ladder fuels would be reduced to decrease crown fire propagation and spread. Alternative 2 is the more aggressive fuel reduction alternative, implementing more area of mechanical treatments which are capable of removing a larger amounts of fuels.

Figure 14. Example of current (left) and desired post-treatment condition (right) conifer stand comparison – before and after treatment. Desired condition photo illustrates a reduction of surface, ladder, and canopy fuels with a retention of larger, healthy, fire resistant pine trees. Location: Pioneer Trail at Al Tahoe Blvd, South Lake Tahoe).

Direct Effects

Condition Class

Under Alternative 2 the overall landscape of the South Shore project area would change from a Condition Class 3 to Condition Class 2. This determination is based on the expected condition of the stands (canopy cover, stand density, etc) as well as fire history and proposed prescribed burning. When using condition class on a landscape level, the condition class changes from a 3 to a 2 and not reduced further due to the scale of the area and lack of fire treatments included in the proposed action. Although this project reintroduces fire into the landscape, the use of fire is not applied to enough areas; therefore, the frequency of fire for the fire history remains low, and fire severity remains moderate, causing the condition class to remain at a level 2. Condition Class Analysis forms used for this project are located in the project record.

When using condition class on a stand level, the condition class changes (from a 3 to a 2 or 1) due to the smaller scale of the area being analyzed. The thinning treatments, as well as prescribed fire (where applicable) are considered for each stand individually. This changes the frequency of fire and fire severity allowing the stand level rating to change to a condition class 1. At a stand level, approximately 4,923 acres proposed for treatment would become Condition Class 1, and 5,747 acres in Condition Class 2.

Surface Fuel Loading

Hand Thinning

Approximately 4,942 acres of units are proposed to be treated by hand thinning. 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 suppressed and intermediate trees in the understory.

Burning of residual fuels would be conducted in most hand thinned stands, following thinning, to remove remaining surface fuels in excess of desired levels (of 10 tons per acre). Residual fuel loads would include logs greater than 20” dbh for wildlife habitat. Stands containing up to 15 tons of residual fuels per acre would usually be located in the wildlife areas or stream environment zones (SEZs).

In some SEZs, the amount of larger (greater than14 inches diameter) standing trees and down logs may be too great for meeting fuel load objectives. Hand carrying material greater than 14 inches diameter to areas outside of the no-pile zone can be difficult and unsafe, and may result in leaving residual fuel loads that are greater than 15 tons per acre.

Total fuel loads are analyzed based on overall stand averages that include both the uplands and SEZs. Effects of hand thinning and pile burning on surface fuel loads would be an overall reduction of fuel loads in all size classes. On average, the total fuel loads are expected to be reduced by about 48%. Approximately 4,843 (or 98%) of the hand treatment stands are predicted to meet desired conditions with levels that are at, or below, the desired maximum range of 10 to 15 tons per acre post treatment (Table 3-6). When including the wildlife areas that would be hand thinned, 86%, of the hand thinned stands are predicted to meet desired conditions.

All hand thinning stands were modeled using FFE using 90% reduction of surface and activity fuels. The remaining 691 acres above the desired 15 tons total per acre are due to the current (previous to treatment) fuel loads. These areas currently have high fuel loads, therefore the 90% modeled reduction isn’t enough to reduce the levels to below 15 tons per acre. A second entry of thinning (and/or piling and burning) for meeting the desired surface fuel loads may be necessary in these areas. Because the stands used overall averages (including both uplands and SEZs together), the 691 acres does not include SEZ areas independently that may need multiple treatments as well.

Stands treated with hand thinning are often limited in meeting desired stand conditions or retaining them for long periods of time. As described for SEZ areas, the size and number of trees felled are limited when treatment requires manual removal and piling of trees after thinning. This applies to some upland areas as well. Approximately 50%, of the hand thin stands would be above the desired fuel loads within 10 years post treatment.

In 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, but are decreased in size and redistributed throughout the stand. Chipping or mastication of fuels decreases vertical fuel heights and redistributes the overall fuel load. Fire intensity and severity may still remain high, however, if the fuel loads are too heavy. The fire remains as a surface fire, but with increased duration and potentially higher 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.

Mechanical Thinning

Mechanical thinning treatments would treat 5,728 forested acres; of those, 3,818 acres would use the whole tree (WT) thinning system and 1,910 acres would use the cut-to-length (CTL) system. 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 suppressed and intermediate trees and some of the codominant trees in the overstory. Prescribed burning would be conducted in 850 acres of the WT yarded stands post-thinning. Mechanical thinning would be conducted in order to remove remaining surface fuels in excess of desired levels of 10 to 15 tons per acre. Residual fuel loads would include 8 to 12 tons of logs greater than 20" dbh for wildlife habitat. Stands with up to 15 tons of residual fuels total per acre would usually be in the wildlife areas or SEZs.

Effects of mechanical thinning and removal of surface fuels would provide for an overall reduction of fuel loads in all size classes. For the WT units, fuel loads would be reduced by about 80%. Approximately 65% of the whole tree units are expected to be below the desired maximum range of 10 to 15 tons per acre. The other 35% of the whole tree stands have higher predicted fuel loads. If necessary, to reduce fuel loading, these areas may be treated with CTL equipment for thinning, grapple piling and burning.

The CTL units would use mastication or chipping after thinning treatments, and would have a higher average fuel loading 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 tons per acre, with the higher fuel loads occurring mainly in the PACs and wildlife areas. Chipping or mastication of fuels decreases vertical fuel height and redistributes the overall fuel load. Fire intensity and severity may still remain high, however, if fuel loads are too heavy. The predicted fire type post treatment would remain a surface fire, but have increased duration and potentially higher flame lengths. Under more severe weather conditions mastication has been shown to not reduce fireline intensities and tree mortality. If necessary, to reduce fuel loading, grapple piling and burning or other methods of removal would occur where post treatment fuel loads are above desired conditions.

The average fuel loads for mechanical stands post treatment would be about 18 tons per acre with approximately 55% of mechanical treatment stands meeting desired fuel loads (Table 3-6). The averages do not reflect the lowering of fuel loads using grapple piling and burning that may be necessary in some areas.

For all the mechanical stands, the average increase of fuels after the treatment for the following 20 years would be about 4 tons per acre, with almost half still meeting the desired fuel load objectives (Table 3-6). The Wildlife Areas would have, on average, higher stand densities thereby having a faster increase of accumulating surface fuels 10 and 20 years post treatment Approximately 17% of the Wildlife Areas would meet fuel load objectives in 20 years.

Table 3-6. Predicted Post-treatment Surface Fuel Loading

Alternative 2	Avg tons/acre
Post-treatment	
Hand Treatment Stands	9
Mechanical Treatment Stands	18
Wildlife Areas	13
TOTAL	13
10 Years Post Treatment	
Hand Treatment Stands	15
Mechanical Treatment Stands	20
Wildlife Areas	18
TOTAL	18
20 Years Post Treatment	
Hand Treatment Stands	21
Mechanical Treatment Stands	22
Wildlife Areas	24
TOTAL	23
Note: Average tons per acre were determined using FFE and are based on initial treatment only. Average tons per acre do not reflect potential grapple pile and burning that may be needed within the mechanically treated units.	

Fire Behavior

Fire Type

With Alternative 2, results of models run on a landscape level for predicted fire type are shown in Table 3-7. Results demonstrate that the reduction of surface fuels, reducing CBD, and raising CBH moderates surface and crown fire behavior. The results from proposed treatment changes fire type from passive and active crowning to surface fires in the majority of the stands. With Alternative 2, approximately 82% of the proposed treatment area would meet desired conditions for having a predicted surface fire type.

Over time, the treated stands would recover in canopy closure and CBD which, along with other variables such as accumulation of surface fuels, would cause the predicted surface fire type to potentially change back to a crown fire type. The time frame for lasting effects from hand thinning is less than mechanical however, all treated areas are expected to last in effectiveness for meeting project goals for over 10 years.

Table 3-7. Alternative 2: Modeled Fire Type Results Post Treatment

Fire Type	Acres	Percentage of Acres
Surface	8831	82%
Passive Crown	1424	13%
Active Crown	415	3%
Total	10,670	100%

Fire Intensity

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For Alternative 2, desired conditions are met in most of the proposed treatment areas. Modeling predictions show that that 87% of the proposed treatment area would result in flame lengths less than four feet should a wildfire occur (Table 3-8). These areas would usually allow for suppression activities to be successful with implementation of hand tools and hand constructed fire line, reducing the risk of fire spread and potentially, increased fire behavior.

Table 3-8. Alternative 2: Predicted Flame Lengths Post Treatment

Flame Length	Acres	Percent of Acres
Less than 4 feet	9332	87%
4 to 8 feet	363	3%
Greater than 8 feet	975	9%
Total	10670	100%

Fire behavior and expected fire type would be influenced in part by surface fuel amount, size and distribution. Stands treated either with mechanical or hand thinning operations (with post treatment of activity fuels such as prescribed burning), would reduce overall fuel loads. The lower fuel loading would help alter the predicted fire type to be that of lower intensity and severity.

Indirect Effects (Alternatives 2 and 3)

Treatments in Alternative 2 and 3 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 also improve. Furthermore, proposed aspen enhancement activities (through conifer thinning and removal), benefit the forest ecosystem and alter fire behavior by reducing the overall fire intensity. Because aspen stands do not burn with the intensity of conifers, enhancing the size and distribution of aspen stands is justified and encouraged within the project's WUI setting (USFS GTR-178, 2006).

If an unplanned ignition should occur during the time between piling and pile burning it is expected that the fire behavior would resemble fire behavior in an untreated stand. Very little difference in convective or radiant heat output would occur because the same amount of fuel would be present on the site to burn. The difference in fire behavior would be limited to the distance embers could be lofted to initiate secondary spot fires. Before treatment occurs, much of the fuel in the handpiles would be located at a greater height (in upper branches and crown foliage) and would burn just as this fuel would burn in adjacent untreated stands. The greater height of the fuel would allow embers to be lofted higher and transported downwind to greater distances. (An Assessment of Fuel Treatment Effects on Fire Behavior, Suppression Effectiveness, and Structure Ignition on the Angora Fire, R5-TP-025, August 2007)

Alternatives 2 and 3 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.

Thinning followed by prescribed fire could result in microclimate change that would encourage the growth of grasses, forbs and brush. Underburning could also encourage this type of growth. This microclimate change could also increase the drying of the surface fuels and increase the mid-flame windspeed. In the event of a wildfire, this growth of grasses, forbs and some brush may result in a low-intensity surface fire with a higher rate of spread. 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. It is important to note that this changed condition resulting from thinning and prescribed burning (one with more understory grasses, forbs, and brush) is more representative of the healthier fuels loading, vegetation structure, and species composition that existed prior to European settlement. Thus, it can be expected that post treatment conditions are more resistant and resilient to large scale disturbances such as wildfire.

Alternative 3 – Preferred Alternative

Alternative 3 would reduce fuels over fewer acres than Alternative 2, treating 10,112 acres, 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.

Direct Effects

Condition Class

The expected result under Alternative 3 as with Alternative 2 is that the condition class for the project area as a landscape would change from a condition class 3 to condition class 2. This determination is based on the expected condition of the stands (canopy cover, stand density, etc) as well as fire history and proposed prescribed burning.

At a stand level for the proposed treatment units, the condition class is based more on the condition of the stand versus the fire history. At a stand level, approximately 4,421 acres proposed for treatment would be improved to Condition Class 1, and 5,716 acres in Condition Class 2.

Surface Fuel Loads

For Alternative 3, the post treatment conditions for surface fuel loads are similar to Alternative 2. Differences are mainly the changes in acres treated with the different treatment types.

Hand Thinning

Hand thinning treatments would be applied on 5,987 forested acres. Total fuel loads would be reduced by about 49%. Approximately 96% of the hand thinned stands are expected to meet desired conditions with levels that are at or below the desired maximum range of 10 to 15 tons per acre post treatment (Table 3-9). When including the wildlife stands that would be hand thinned, approximately 5,289 acres, or 91%, of the hand thinned stands would meet desired fuel loads. All hand thinning stands were modeled using FFE using 90% reduction of surface and activity fuels. The remaining 698 acres above the desired 15 tons per acre are due to the current (previous to treatment) fuel loads. These areas currently have high fuel loads so the 90% modeled reduction isn't enough to reduce the levels to below 15 tons per acre. A second entry of thinning and or piling and burning for meeting the desired surface fuel loads may be necessary in these areas.

Stands treated with hand thinning are often limited in meeting desired stand conditions or retaining them for long periods of time. Approximately 42%, of the hand thin stands would be above the desired fuel loads within 10 years post treatment.

Approximately 692 acres have been identified for chipping or masticating within hand thin units, an increase of 339 acres from Alternative 2. Chipping or masticating hand thinned stands or portions of hand thinned stands would only occur where site conditions are acceptable for ground based equipment operations and post treatment fuel loads would meet desired conditions. With chipping or mastication, the fuels are not reducedas 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. The fire remains as a surface fire, but with increased 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

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. Residual fuel loads would include 8 to 12 tons of logs greater than 20” dbh for wildlife habitat. Stands with up to 15 tons per acre of residual fuels would usually be in the wildlife areas or SEZs.

The average fuel loads for mechanical stands post treatment would be about 16 tons per acre with approximately 66% of mechanical treatment stands meeting desired fuel loads (Table 3-9). 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. The other 18% of the whole tree stands would have higher fuel loads ranging from about 15 to 25 tons per acre. If necessary, to further reduce fuel loading, these areas may be treated with CTL equipment for thinning, grapple piling and burning. 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 14 tons per acre (Table 3-9).

The average fuel loads for mechanical stands post treatment would be about 16 tons per acre with approximately 66% of mechanical treatment stands meeting desired fuel loads (Table 3-9). The averages do not reflect the lowering of fuel loads using grapple and burning that may be necessary in some areas.

For all the mechanical stands, over half would still meet the desired fuel load objectives 20 years post treatment (Table 3-9), next page. The Wildlife Areas would have, on average, higher stand densities thereby having a faster increase of accumulating surface fuels 10 and 20 years post treatment. Approximately 14% of the Wildlife Areas would meet fuel load objectives in 20 years.

Table 3-9. Alternative 3: Surface Fuel Loading

Alternative 3	**Ave tons per acre**
Post-treatment	
Hand Treatment Stands	11
Mechanical Treatment Stands	16
Wildlife Areas	14
TOTAL	14
10 Years Post Treatment	
Hand Treatment Stands	17
Mechanical Treatment Stands	18
Wildlife Areas	19
TOTAL	18
20 Years Post Treatment	
Hand Treatment Stands	22
Mechanical Treatment Stands	19
Wildlife Areas	25
TOTAL	22
Note: Average tons per acre were determined using FFE and are based on initial treatment only. Average tons per acre do not reflect potential grapple pile and burning that may be needed within the mechanically treated units.	

Fire behavior and expected fire type would be influenced in part by the amount, size, distribution of surface fuels and the CBD and CBH of the residual stand. Stands treated either with mechanical or hand thinning operations with a post treatment of activity fuels such as prescribed burning, would reduce overall fuel loads. The lower fuel loading would help alter the predicted fire type to be that of lower intensity and severity.

Fire Behavior

Fire Type

With Alternative 3, results of models run on a landscape level for predicted fire type are shown in Table 3-10. Results demonstrate that the reduction of surface fuels, reducing CBD, and raising CBH moderates surface and crown fire behavior. The results from proposed treatment changes fire type from passive and active crowning to surface fires in the majority of the stands. With Alternative 3, approximately 85% of the proposed treatment area would meet desired conditions for having a predicted surface fire type.

Over time, the treated stands would recover in canopy closure and CBD which, along with other variables such as accumulation of surface fuels, would cause the predicted surface fire type to potentially change back to a crown fire type. The time frame for lasting effects from hand thinning is less than mechanical however, all treated areas are expected to last for over 10 years.

Table 3-10. Alternative 3: Modeled Fire Type Results

Fire Type	Acres	Percent of Acres
Surface	8631	85%
Passive	1178	12%
Active	303	3%
Total	10,112	100%

Fire Intensity – Flame Length

With Alternative 3, desired conditions are met in most of the proposed treatment areas. Modeling predictions show that approximately 89% of the proposed treatment area would result in flame lengths less than four feet should a wildfire occur (Table 3-11). These areas would usually allow for suppression activities to be successful with implementation of hand tools and hand constructed fire line, reducing the risk of fire spread and potentially, increased fire behavior.

Table 3-11. Alternative 3: Modeled Flame Length Results

Flame Length	Acres	Percent of Acres
Less than 4 feet	8932	89%
4 to 8 feet	426	4%
Greater than 8 feet	754	7%
Total	10,112	100%

Effects Comparison by Alternative

Both action alternatives are predicted to 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 are shown below in Table 3-12.

The increase in hand thinning in Alternative 3 would result in slightly higher average fuel loads than the hand thinning in treatments in Alternative 2. However, the higher average fuel loads would meet the desired conditions for the Wildlife Protected Activity Centers (PAC). Both alternatives meet desired condition for predicted fire types for all areas treated (Table 3-12).

Table 3-12. Summary of Alternatives for Fire Behavior and Fuels

Alternative	Treated Acres	Condition Class	Fuel Load (tons/acre)	Fire Type (acres)	Fire Intensity – Flame Length (acres)
1 – No Action	0*	CC 1 – 1,230 CC 2 - 2,687 CC 3 - 6,753	8-66 t/a	Surface 684 Passive Crown 6,578 Active Crown 3,408	< 4 feet -2,424 4 to 8 feet 1,914 > 8 feet 6,332
Post Treatment					
2 – Proposed Action	10,670	CC 1 – 4,923 CC 2 – 5,747 CC 3 - 0	10-15 t/a	Surface 8831 ac Passive Crown 1424 Active Crown 415	< 4 feet 9332 4 to 8 feet 363 > 8 feet 975
3- Preferred Alternative	10,112	CC 1 4,421 CC 2 - 5,691 CC 3 - 0	10-15 t/a	Surface 8631 ac Passive Crown 1178 ac Active Crown 303 ac	< 4 feet 8932 ac 4 to 8 feet 426 ac > 8 feet 754 ac
* Acres modeled - 10,670					

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 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 all the other past, present and foreseeable projects do not reduce fuels on enough of the landscape to make a difference. Localized reduction in fire behavior on treated parcels would be effective but only on the treated parcel and possibly on adjacent areas depending on the site specific conditions. In addition this alternative would not meet the forest health, SEZ and aspen objectives..

Alternatives 2 and 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 and on going treatments on adjacent ownerships 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.

Analytical Conclusions

This section provides a brief summary of the effects analysis for fire and fuels. It provides linkage from resource protection measures in Chapter 2 to the magnitude, scope, and intensity of the environmental effects for fire behavior and hazardous fuel load changes due to project activities.

The major factors for wildfire behavior are weather, topography, and available fuel. The one factor of that management activities can influence is the availability of fuel. As designed, the project would reduce the availability of fuel by reducing the overall fuel in tons per acre and by changing the vegetation structure by reducing ladder fuels. Analytical models of fire behavior at both the landscape scale and the stand scale demonstrate that the prescriptions for vegetation management are effective to change fire behavior in the South Shore project area.

The No Action Alternative (Alternative 1) fails to reduce the risk to neighborhoods and communities from high intensity wildfire. Alternative 1 would not change fire behavior. Flame lengths would remain >4 ft. on over 75% of the proposed project area, and direct suppression activities would not be an option on a majority of the project area due to safety concerns for firefighters. The potential for high intensity wildfire to occur in the project area would remain high, with approximately 75% expected to burn at flame lengths greater than 8 feet, and over 50% would be expected to burn as a crown fire with high levels of tree mortality. Existing conditions over much of the project area are similar to the pre-existing conditions in the Angora Fire area, and fire behavior would be similar to the 2007 Angora Fire under similar fire weather conditions.

Alternative 3 would reduce fuels over fewer acres than under Alternative 2,
both action alternatives are effective in changing fire behavior across the landscape and achieving the desired change from crown fire to surface fire and reduction in flame lengths to allow direct suppression for protecting neighborhoods and communities. Surface fuel loads with Alternative 1 would continue to average 24 tons per acre, while both action alternatives would reduce surface fuel loads by approximately 50%, to an average of10-15 tons per acre . This reduction, combined with reducing ladder fuels is sufficient to reduce the likelihood for high-intensity crown fire by 30% in alternative 2 and approximately 25% in alternative 3. . The resulting flame length reduction to <4 ft. under the action alternatives increases firefighter safety for direct suppression activities for 65% of the acres within the project under Alternative 2 and 88% under Alternative 3.

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Forest Vegetation

Scope of the Analysis and Indicators of Effect

The forest vegetation stands for this project were identified and analyzed based on three types of treatments: 1) mechanical treatments, 2) hand treatments, and 3) mechanical and hand treatments emphasizing wildlife habitat. Stands suitable for mechanical treatment have slopes less than 30% and access is available for ground-based equipment to fall and remove trees, and down wood. 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. Both mechanical and hand treatments stands occur in both uplands, and SEZs which may also include meadow and aspen stands. Treatments emphasizing wildlife habitat for special status species (hereafter referred to as wildlife areas) include California spotted owl protected activity centers (PACs) and home range core areas (HRCAs), northern goshawk PACs, TRPA disturbance zones for northern goshawk and osprey, and TRPA bald eagle wintering habitat. Wildlife areas also may occur in both upland and SEZ landscapes, would be treated by hand or mechanical methods, and would have prescriptions specifically designed for the type of wildlife area. Proposed treatment prescriptions are described in Chapter 2.

The analysis for the treatment types are 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. Stand exam plot data was collected within random plots distributed throughout the project area during the 2006 and 2007 field seasons. The data collected include tree species, diameters, and heights. The collected data was entered into the FVS program to model current forest density conditions based on trees per acre (TPA), basal area (BA), and stand density index (SDI). Data collected also included dwarf mistletoe ratings to determine level of infection and number of infected trees.

The effects of the proposed treatments are not based individual tree counts, but on FVS projections of stands with inventory data, and are representative of average stand conditions. The FVS model is used as a tool for determining expected outcomes from treatments for the comparison of the effects of the alternatives. The modeling in this section reflects projected forest vegetation conditions, without the influence or effects of wildfire. Fire behavior modeling information is contained in the previous section – fire behavior and fuels.

The proposed prescriptions presented in Alternatives 2 and 3 were based on this initial stand level analysis data then further modified as needed to meet resource concerns as detailed in the resource protection measures.

Indicators

For purposes of this analysis, the following indicators of stand conditions and forest health were discussed for each alternative: stand composition and structure, stand density, and forest health.

Stand Compositionand Structure

Species composition throughout the project area varies by location, such as stream zones and meadows, elevation, past management practices, as well as other environmental or topographical factors. Much of the project area has a higher than desired number of shade tolerant species such as white fir, and incense cedar in the uplands and encroaching lodgepole pine in the riparian areas. Stands also have a higher than desired amount of smaller diameter trees in the understory. The desired condition is to have uneven aged stands with large, widely spaced trees in the overstory with a few scattered understory trees. Tree species consist mainly of shade intolerant Jeffrey pine and sugar pine or red fir in the higher elevations. The expected change by treatment in species composition and structure was analyzed for each alternative.

Stand Density

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 and sequester carbon at increasingly slower rates as trees become stressed for resources such as soil nutrients, water, and sunlight. Trees are able to withstand drought conditions better when at lower stand densities with sufficient available growing space and resources and when inter-tree competition does not have a large effect on stand growth (Long 1985). For the South Shore project, maximum SDI (MSDI), is used for analysis in determining stand density conditions for each alternative. The desired stand densities for overall forest health objectives as measured in SDI is about 40% of the maximum. At 40% MSDI, the stand is at the lower limit of full site occupancy (Long 1985). In order to implement appropriate stand density levels, basal area as measured in square feet per acre, was also used in correlation with the desired SDI levels.

Basal area is the cross sectional area of a tree bole measured at diameter at breast height (dbh), which reflects varying levels of stand densities depending on a stand's average diameter. Basal area is used as a measure of stand density which corresponds to forest health issues such as mortality due to competition among trees as they fight for water and soil nutrients, and susceptibility to insect and disease outbreaks. When basal areas exceed levels of about 150 ft^2 per acre, bark beetle populations are more likely to expand into outbreak levels, killing a large number of trees (Fettig et al 2007). Optimal levels at which infestation is less likely would be approximately 80 ft^2 per acre. For the South Shore project, basal area is used for analysis in determining stand density conditions for each alternative. The desired stand densities as measured in basal area for the stands would range between approximately 80-150 ft^2 per acre.

Forest Health

Dwarf mistletoe (*Arceuthobium spp.*) is a small parasitic plant that grows exclusively on conifer stems and branches and is almost completely dependent on its host trees for food and water. Dwarf mistletoes weaken trees by slowly robbing them of both nutrients and water. Heavy infections can lead to severe growth loss and decreased survival. The length of time it takes for mistletoe to actually kill a heavily infected tree will vary depending on a number of factors including the size of the tree, vigor, species involved, and whether insects, particularly bark beetles, also attack the tree due to the stress of infestation. Dwarf mistletoe spreads through a stand by shooting its seed through the air from one tree to another. Average distance of seed dispersal is approximately 30 feet.

Dwarf mistletoe infection 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. Dwarf mistletoe intensity (DMI) is the average DMR for infected trees only. DMI and the trees per acre infected by dwarf mistletoe (DM-TPA) were used for anlaysis in determining infection level and amount of spread with each alternative.

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 saprophyte (an organism that obtains food from dead or decaying organic matter). The threat of spread of annosus root disease was analyzed for each alternative.

There are two common 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 in the stand. The risk of bark beetle outbreak was analyzed for each alternative.

Existing Conditions – Forest Vegetation

Stand Composition and Structure

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 type (Table 3-13). Lodgepole pine occupies areas near and encroaching into streams and meadows, while red fir and subalpine conifers are found in the higher elevations (Map 11).

Table 3-13. Project Analysis 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 whitethorn, 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, being overtopped or encroached by conifers.

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 FS 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 overstory component. 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. (Refer to Section A. Fire and Fuels for more details on existing conditions for fuels and wildfire potential.)

Project treatment areas 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 3-14).

Streamside vegetation and the aspen (*Populus tremuloides*)/meadow community type also occur in some of the project 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 3-14. 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

Stand Density

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

The overall average basal area (BA) 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 average quadratic mean diameter of live trees ranges from as low as 3 inches dbh up to 34 inches dbh. Approximately 65 percent or 6,918 acres of the project area includes forest stands that are at or above 60% of maximum Stand Density Index (MSDI). Most of these stands have an average SDI ranging from 70% to over 100% of maximum. The overall average is about 84%.

Forest Health

Precipitation is variable throughout the western United States, including the Sierra Nevada mountain range. Forest types vary in part, to their response to the amount of annual precipitation. For all forest types, as stand densities increase, water availability becomes a limiting factor for tree health, and during drought conditions, moisture stress and mortality increases.

When stand densities are within the range of desired conditions, sunlight, nutrients, and water are more available for trees to use in the process of photosynthesis to capture CO_2 from the atmosphere and sequester the carbon in the plant tissue, releasing oxygen (O_2) as a byproduct of plant respiration. Healthy forest conditions aid to counteract human-caused CO_2 accumulation in the atmosphere. Climate change predictions of warmer and possibly drier conditions in the central Sierra Nevada, including the Lake Tahoe Basin, would indicate that increased stress and mortality would be expected within the existing conditions of overly-dense stands. As trees die, carbon sequestration ceases, and the decay process releases the sequestered carbon slowly into the atmosphere. Forests play a major role in the carbon cycle. Over the long-term, as long as forests exist, they will continue to absorb and sequester carbon.

Dwarf mistletoe (*Arceuthobium spp.*) infection occurs throughout the project area infecting both white fir and Jeffrey pine. The mistletoe is found in both overstory and understory trees with the level of infection varying from light to heavy. The stands infected with dwarf mistletoe are moderately dense to very dense, with susceptible host trees in close proximity to one another allowing easier spread. *H. annosum* is also present in the South Shore project area, and infects the red and white fir species.

There are a number of bark beetle species present and active within the project area. Typically, widespread bark beetle attacks occur in dense stands in conjunction with drought conditions when trees are already under stress. Bark beetles are also often found in association with trees infected with dwarf mistletoe or other diseases.

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.

Environmental Consequences – Forest Vegetation

Direct and Indirect

Alternative 1 – No Action

Stand Composition and Structure

Under the No Action Alternative the desired stand composition and structure would not be met. 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.

Aspen

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. As the encroaching conifers increase in growth they would out-compete the aspen stands for light resources. (Shepperd et al 2006).

Stand Density

Under the No Action Alternative the desired stand density conditions would not be met. Effects include an increase in stand densities (Table 3-15) 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.

Table 3-15. Current and Predicted Stand Densities for the Project Area

	Current Ave % MSDI	Current Ave BA (ft^2)	10 Years % MSDI	10 Years Ave BA	20 Years % MSDI	20 Years Ave BA
Project Area	84	200	92	228	99	255

With little or no disturbance, growth and 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.

Under current conditions, natural disturbance such as wildfire could dramatically 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. The resulting stand conditions may be similar in some areas to what can be seen in the Angora Fire area with vast open areas of little to no vegetation. Although most of the fire burned at high intensities in areas that were not previously treated, approximately 40% of the Angora Fire burned at low to moderate intensities in areas that were previously treated creating a mosaic of both live and standing dead trees and a patchy understory of shrubs and other vegetation.

Forest Health

With the No Action alternative, carbon sequestration rates in stands near or above 60% of MSDI would continue to decrease. As stands reach and persist at maximum densities, they would remain at high risk of widespread mortality which would also result in release of additional CO_2 into the atmosphere through the process of decay. If a wildfire were to occur, a very high amount of CO_2 is expected to be released into the atmosphere, but would depend on the intensity and size of the fire.

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 and decrease in successful regeneration.

The Mean Dwarf Mistletoe Index (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 (DM-TPA) 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.

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.

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 MSDI 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 forest stands within the project area are at or above 60% of MSDI. 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 MSDI 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.

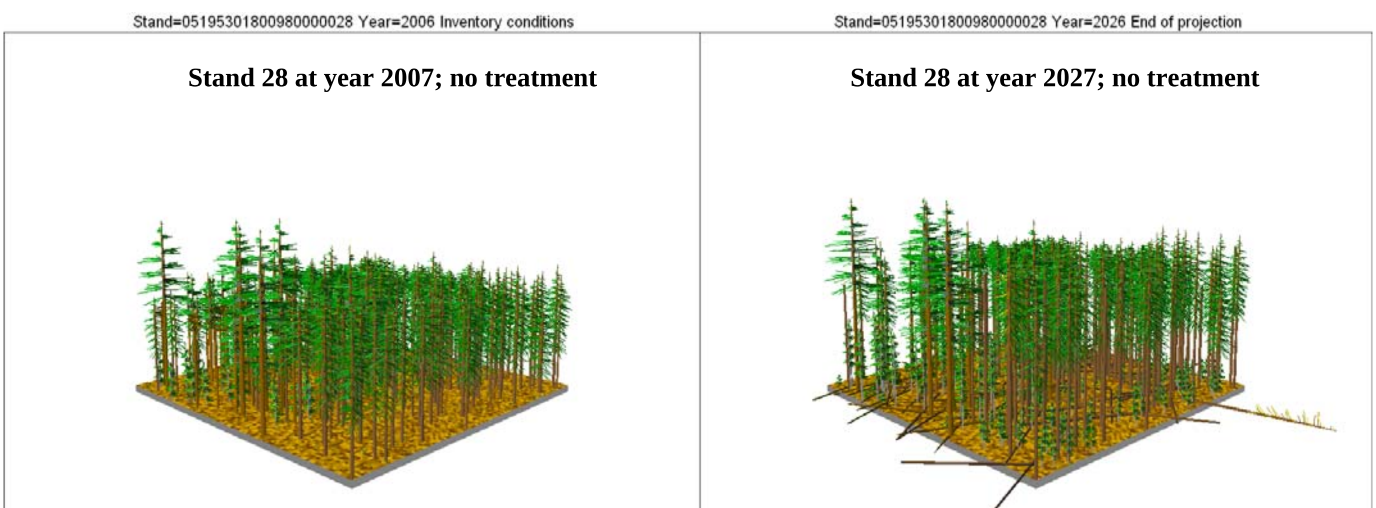
Using the FVS model, a representative stand was chosen for simulating resulting stand conditions over time with no treatment. The representative stand is a mixed conifer stand currently above MSDI level and would have high mortality occurring over the next 20 years, which would lower the trees per acre, 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 3-16).

Table 3-16. Typical Stand Conditions over 20 Years Based on a Representative Stand

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

TPA – Trees per Acre, BA – Basal Area, SDI – Stand Density Index, DMI – Dwarf Mistletoe Intensity, DM-TPA – Dwarf Mistletoe-Trees per Acre

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. Average stand conditions of the modeled stand at current 2007 and projected to year 2027 are pictured below (Figure 15).



Source: USDA Forest Service, "Forest Vegetation Simulator"

Figure 15. Stand conditions at year 2007 and 2027 with no treatment

Given current vegetation conditions should a wildfire occur under severe weather conditions it is expected that much the area burned would burn at high intensities. With high intensity fires there would be high tree mortality, as well as damage to residual trees including charring of the bark and boles and mortality of some of the branches. Surviving trees would be at a higher risk of attack from bark beetles due to stress from injury to itself or surrounding damaged trees. Any increase in occurrence of disease to surviving trees due to stress would also increase risk of bark beetle attack.

Alternative 2 – Proposed Action

Stand Composition and Structure

In Alternative 2 there are approximately 10,670 acres proposed for treatment within the South Shore project area. 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 areas would have more of the smaller trees in the understory retained to meet required habitat conditions.

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 riparian 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.

Stand Density

Hand Thinning Treatment Areas

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. Post treatment values in this analysis is based on stand level data averaging together both the uplands and SEZs.

Hand thinning treatment would generally cut and remove lodgepole pine, white fir, red fir and incense cedar in the understory. Generally, the size of cut trees would be within 14 inches dbh or less; however, approximately 10 stands totaling 330 acres would have trees up to 20 inches dbh cut. Desired residual stand densities would include maximum SDIs of about 40%, and BAs ranging 80ft^2 to 150ft^2

Approximately 2,021 acres of the hand thinned stands would meet desired SDIs and BAs, including 365 acres of the wildlife areas. The remaining 2,921 acres would be above the desired stand density levels because 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. The average MSDI post treatment would be 50% (Table 3-17)

Approximately 1,481 acres identified for hand treatment in Alternative 2 are located within 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 3-17).

Table 3-17. Post Treatment Values, and then After 10 and 20 Years (Hand)

Treatment	Post Treatment Ave % MSDI	Post Treatment Ave BA (ft^2)	10 Years Ave % MSDI	10 Years Ave BA	20 Years Ave % MSDI	20 Years Ave BA
Hand Thin	49	150	53	173	60	197
Hand Thin – WA*	57	177	59	204	65	230
All Hand Thin	**50**	**157**	**56**	**180**	**61**	**205**
* Wildlife areas						

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 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 approximately 20 years.

Ongoing maintenance treatments such as thinning or prescribed burning 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 Treatment Areas

Mechanical thinning treatments would occur on 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 $80ft^2$ to $150ft^2$ 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, 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 (SNFPA ROD, USDA FS 2004c). The current 30 inch diameter limit for thinning stands would limit meeting the desired stand conditions after treatment on about 21acres.

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 areas. The average TPA over all stands would be approximately 65 TPA.

The overall average SDI for mechanical stands outside of wildlife areas would be just under 40% MSDI. Total average including wildlife areas would be about 46% (Table 3-18). After 20 years, most of those stands would still be in the desired average stand density range. Only about 50 acres of mechanically thinned stands would be above the maximum SDI level of 60% after 20 years post treatment.

Approximately 2,696 acres of mechanical treatment stands are located within 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 areas would not meet desired SDIs and BAs after initial treatment. Resulting stand densities in wildlife areas would average about 55% max SDI (Table 3-18). Resulting stand densities in wildlife areas would average about 71% max SDI within 20 years after treatment

Table 3-18. Post Treatment values, and then After 10 and 20 Years (Mechanical)

Treatment	Post Treatment Ave % Max SDI	Post Treatment Ave BA (ft^2)	10 Years Ave % Max SDI	10 Years Ave BA	20 Years Ave % Max SDI	20 Years Ave BA
Cut-to-Length	37	106	45	129	51	150
Whole Tree	39	120	45	138	50	159
Mechanical - WA	55	166	65	186	71	210
All Mechanical	**46**	**137**	**55**	**159**	**61**	**184**

With Alternative 2, mechanically thinned stands outside of wildlife areas, 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.

Ongoing maintenance treatments such as thinning or prescribed burning 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.

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, establishment of natural vegetation is 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 (SNFPA ROD, USDA FS 2004c). 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.

Prescribed Burning

Prescribed pile and burning would be conducted in hand thinned stands and in of some of the mechanically thinned stands post thinning. Prescribed underburning would also be conducted in some of the mechanically thinned stands post thinning. Prescribed burning occurs under weather conditions that promote low flame lengths and low burning intensities, however may result in damaging or killing residual trees. Mortality of up to 15% of the residual trees in the stand is expected. Mortality from prescribed burning would primarily occur in smaller understory trees that have thinner bark and crowns closer to ground level. With the diameter limitations for falling trees within the hand thin units, this mortality is not only acceptable but in some cases desirable. The stand densities for meeting the objectives are often not met with hand falling and piling because of the size of the trees. Mortality of some of the understory, shade tolerant trees would help to meet those objectives. Damage that may occur to residual trees includes scorching from convective heat or direct flame contact. This may result in charring of the bark and boles of the trees and mortality of the lower branches. This does not necessarily kill the trees and generally improves forest stand resiliency to wildfire.

Natural disturbance such as wildfire could dramatically 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. The proposed action is designed to change fire behavior by increasing the area that would burn at lower intensities and decrease the areas that would burn at high intensities. With most areas burning at lower intensities, it is expected that there would be a much higher tree survival rate, creating mosaic of both live and standing dead trees and a patch understory of shrubs and other vegetation.

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. Although there is an initial decrease of carbon sequestration rates from the tree removal and prescribed burning, there would be an increase over time with the healthy growth of residual trees. There would be less CO_2 released due to less mortality occurring from otherwise high stand densities. With the reduced risk of active fire versus surface fire, there would be a reduced amount of CO_2 released should a wildfire occur.

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 (> 30” dbh) 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. The Mean DMI for stands that were modeled using FVS is about 0.8 with increases of about 0.2 over 20 years. The number of trees infected (DM-TPA) decreased by an average of 41 trees per acre over 20 years, and the average mortality also decreased by about 7 TPA.

Annosus Root Disease

With alternative 2, there would be exposed stumps from both the hand and mechanical thinning treatments. Potential spread of H. *annosum* would be minimized with the application of an EPA registered borate compound (Sporax) to all cut stumps of true fir and pine trees greater than 14 inches in diameter.

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).

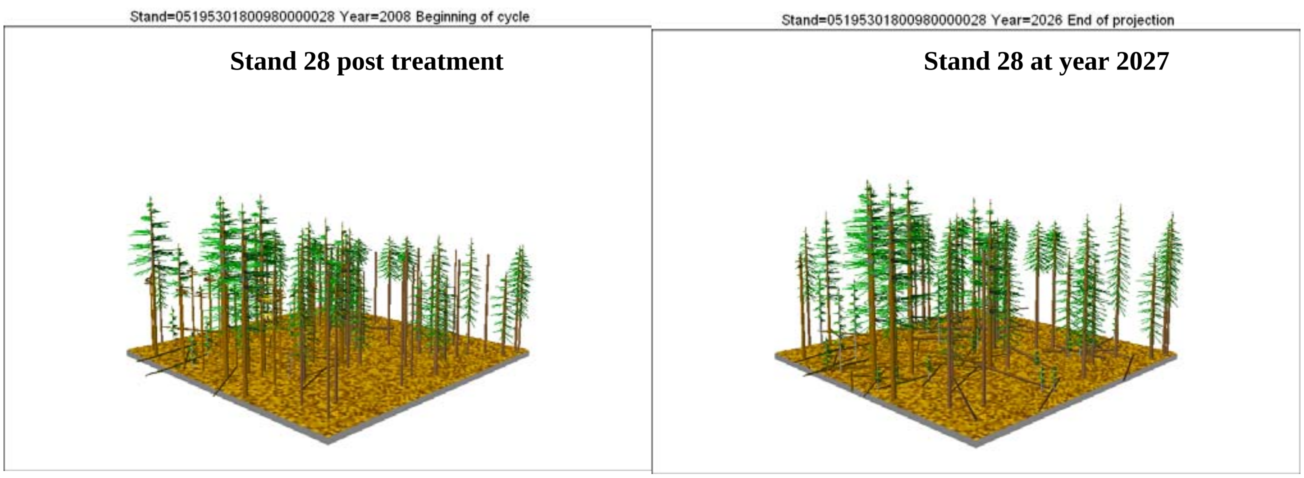
High levels of Sporax are considered toxic to soil microorganisms and plants. Application rates of 9 to 15 lbs per 100 square feet (ground surface area) applied directly to vegetation will eradicate plants (Dost et al. 1996). These levels are much higher than application rates proposed for stump treatment. 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).

Bark Beetle

Thinning would decrease the risk of stand mortality caused by bark beetles by reducing stand density levels to below 60% MSDI. 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 attack. Approximately 67 percent or 7,126 acres of stands within the project area would be below 60% of MSDI post thinning. Within 20 years, approximately 53 percent of the area would remain below 60% of MSDI.

The same representative stand that was projected for the No Action alternative existing conditions shown in Figure 3-5 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 3-5 above, and is shown post treatment and after 20 years in Figure 16 below.



Source: USDA Forest Service, "Forest Vegetation Simulator"

Figure 16. 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 3-19).

Table 3-19. 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

Prescribed pile burning and underburning may cause some damage to residual trees including scorching from convective heat or direct flame contact. This may result in charring of the bark and boles of the trees and mortality of the lower branches. Damage to trees from burning or other falling operations may result in a greater risk of insects or disease attack.

With Alternative 2, should a wildfire occur it is expected that the area burned would burn at mostly low intensities. With low intensity surface fires, there may some damage to residual trees including charring of the bark and boles and mortality of the lower branches. Damage to trees from a wildfire may result in a greater risk of insects or disease attack.

Alternative 3 – Preferred Alternative

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 3-20). There is also a shift in mechanical treatment acres from whole tree to cut-to-length methods. With Alternative 3 the total treatment acres is reduced by 558 acres (Table 3-20).

Table 3-20. Comparison of Total Acres of Treatments for Both Alternatives

Treatment Type	Alternative 2 Acres	Alternative 3 Acres	Difference Acres
Hand Thinning	4,942	5,961	1,019
Cut-to-Length	1,910	2,010	100
Whole Tree	3,818	2,141	-1,677
Total	10,670	10,112	-558

The amount of stands treated within wildlife areas would also be reduced (Table 3-21). Changes to treatments are aimed at reducing impacts to sensitive species and their habitats as discussed in the wildlife section of this analysis.

Table 3-21. Comparison of Total Acres of treatments within Wildlife Areas for Each Alternative

Wildlife Areas Treatment	Alternative 2 Acres	Alternative 3 Acres	Change Acreage
Hand Thin WA	1,481	1,962	412
Mechanical WA	2,696	1,728	-1,168
Total Wildlife Areas	4,177	3,690	-487

Alternative 3 would have fewer total acres of thinning treatments than Alternative 2 but the amount of pile burning would increase because Alternative 3 would 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. See Table 2 in Chapter 2 for a comparison of activity acres for the action alternatives.

Stand Composition and Structure

Stand compostion and structure would be the same with Alternative 3 as Alternative 2. 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 areas would have more of the smaller trees in the understory retained to meet required habitat conditions.

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 except that Alternative 3 proposes treating 42 fewer acres than Alternative 2.

Stand Density

Hand Thinning

For Alternative 3, hand thinning would be applied on 5,961 forested acres. The overall average maximum SDI would be about 49% consisting of 2,075 acres that would meet desired SDIs and BAs post treatment including approximately 736 acres of wildlife areas. Wildlife areas would average about 53% MSDI post treatment (Table 3-22).

Table 3-22. Post Treatment Values and After 10 and 20 Years (Hand)

Treatment	Post Treatment Ave % Max SDI	Post Treatment Ave BA (ft^2)	10 Years Ave % Max SDI	10 Years Ave BA	20 Years Ave % Max SDI	20 Years Ave BA
Hand Thin	50	149	55	170	61	193
Hand Thin – WA*	53	161	60	187	66	211
All Hand Thin	**49**	**147**	**56**	**171**	**62**	**196**

* Wildlife areas

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. 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. Trees 30 inches dbh and greater would only be cut to facilitate operability (SNFPA ROD, USDA FS 2004c).

The current 30 inch diameter limit for thinning stands would limit meeting the desired stand conditions of 40% MSDI after treatment on about 11 acres. The overall average for mechanical stands outside of wildlife areas would be just under 40% MSDI (Table 3-23). After 20 years only about 91 acres of mechanically thinned stands would be above the MSDI level of 60%. For the Wildlife areas, the average post treatment would be just under 60% MSDI and at 72% after 20 years (Table 3-23).

Table 3-23. Post Treatment Values and After 10 and 20 Years (Mechanical)

Treatment	Post Treatment Ave % MSDI	Post Treatment Ave BA (ft^2)	10 Years Ave % MSDI	10 Years Ave BA	20 Years Ave % MSDI	20 Years Ave BA
Cut-to-Length	36	103	45	126	52	151
Whole Tree	37	117	45	122	50	159
Mechanical - WA	58	169	66	196	72	218
All Mechanical	**47**	**137**	**55**	**160**	**61**	**184**

Thinning 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 3-24).

Table 3-24. Summary of Roads and Landings Needed between Alternatives 2 and 3

	Alternative 2	Alternative 3	Decrease
New temporary roads	4.8 miles	3.3 miles	-1.5 miles
Existing temp roads	8.8 miles	6.5 miles	-2.3 miles
Number of Landings	219	168	-51 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 to total approximately 3.3 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 (SNFPA ROD, USDA FS 2004c). 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.

Prescribed Burning

As with Alternative 2, prescribed underburning or pile burning post-thinning would remove excess remaining surface fuels resulting in reduction of surface fuels to the desired levels of less than 10 to15 tons per acre. The effects of prescribed burning would be the same as described in Alternative 2. Changes expected from a natural disturbance such as wildfire are also the same as described in Alternative 2.

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. As in Alternative 2 there would be less CO_2 released due to less mortality occurring from otherwise high stand densities. With the reduced risk of active fire versus surface fire, there would be a reduced amount of CO_2 released should a wildfire occur.

Dwarf Mistletoe

Effects from implementation of Alternative 3 are similar to Alternative 2. Alternative 3 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. The Mean DMI for stands that were modeled using FVS is about 0.8 with increases of about 0.2 over 20 years. The number of trees infected (DM-TPA) decreased by an average of 40 trees per acre over 20 years, and the average mortality also decreased by about 7 TPA.

Annosus Root Disease

As discussed in Alternative 2, there would be exposed stumps from both the hand and mechanical thinning treatments. 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 14 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.

Bark Beetle

Thinning would decrease the risk of stand mortality caused by bark beetles by reducing stand density levels to below 60% MSDI. Approximately 65 percent, or 6,916 acres, within the project area would be below 60% of MSDI post thinning. Within 20 years, approximately 4,979 acres would remain below 47% of MSDI.

As with Alternative 2, prescribed pile burning and underburning may cause some damage to residual trees including scorching from convective heat or direct flame contact. This may result in charring of the bark and boles of the trees and mortality of the lower branches. Damage to trees from burning or other falling operations may result in a greater risk of insects or disease attack.

Should a wildfire occur it is expected that the area would burn at mainly low intensities. With low intensity surface fires, there may some damage to residual trees including charring of the bark and boles and mortality of the lower branches. Damage to trees from a wildfire may result in a greater risk of insects or disease attack.

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 areas. 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 3-25). Both action alternatives would retain fire-resistant stands with densities that provide resistance to insects and disease and overall healthier forest.

Table 3-25. Stand Density Summary for All Alternatives

Alternative		Hand Thin	Mechanical Thin	Wildlife Areas	Untreated Stands	All Stands
1 No Action	Acres	N/A	N/A	N/A	10,670	10,670
	Ave % Max SDI	N/A	N/A	N/A	84	84
	Ave BA	N/A	N/A	N/A	200	200
	Acres >40% MSDI	N/A	N/A	N/A	8,550	8,550
2 Proposed Action	Acres	3,392	3,032	4,246	0	10,670
	Ave % Max SDI	49	38	56	N/A	48
	Ave BA	150	113	172	N/A	144
	Acres >40% MSDI	1,805	21	2,798	N/A	4624
3 Preferred Alternative	Acres	3,999	2,423	3,690	558	10,670
	Ave % Max SDI	50	37	56	75	54
	Ave BA	150	110	165	168	149
	Acres > 40% MSDI	2,686	11	2,712	472	5,881

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 Effects

Analysis of cumulative effects is based on management activities that have or is expected to occur within the project area. The area considered for silviculture cumulative effects is the project area because stand growth and development is primarily dependent on site conditions such as soils, elevation and precipitation. Stand and site conditions elsewhere (outside of the treated stands) generally have little effect on treated stands, with the exception of effects on forests insect populations.

Activities and management since 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 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 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 would have consumed some of the small trees, have been suppressed. Fire exclusion has 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 and structure, and density as described in the “Existing Conditions” section, account for and include changes as a result of past actions. All known major past activities from 1986 through 2010 that occurred on Forest Service lands and other known Community Fire Safe Projects,are summarized below (Table 3-26). In some cases activies may overlap, for example most units treated by hand thinning are also pile burned. As a result the acreages shown in Table 3-26 are not additive.

Table 3-26. Activities within the Project Area from 1986 to 2010

Activity	Acres
Hand Thin	6,583
Pile Burn	14,888
Under Burn	5,657
Mechanical Thinning	9,319
Mechanical Chipping or Mastication	10,048
Hand Lop and Scatter	1,477
Helicopter Yarding	849

Past hand and mechanical thinning primarily entailed thinning from below similar to the action alternatives 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 effect on stand growth or understory regeneration. Ground disturbance from vehicles accessing firewood can injure small trees as well as expose mineral soil as a seed bed for new seedlings, however live overstory trees still provide the most dominant influence on understory development.

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 Angora Fire occurred in June 2007 and burned approximately 3,100 acres within the South Shore project area. The fire altered the stand conditions by creating large areas of openings where only snags of various sizes currently exist. In some areas (about 40%) the fire burned at low to moderate intensities creating a mosaic of both live and standing dead trees and a patch understory of shrubs and other vegetation. In most areas within the burn, the stand densities where reduced to desired or below desired densities.

Foreseeable Future Activities

Activities currently planned on Forest Service land within the project area include the Angora Fire Restoration project. The Angora Fire Restoration project proposes to remove most of the snags left in the burn area as well as live trees where stand densities are above desired levels. The treatments proposed include a mix of mechanical, and hand removal operations. Post operations fuel treatments include, lopping and scattering, chipping or masticating, and hand piling and burning. The total acres for treatment are approximately 1,411 acres consisting of up to 964 acres of mechanical treatment and up to 447 acres of hand removal. Adjacent to the project, the City of South Lake Tahoe, Lake Valley Fire Protection District, Fallen Leaf Lake Fire Protection District, and California Tahoe Conservancy are implementing fuels and vegetation treatments on state and private lands. This work is being done as part of the Lake Tahoe Basin Multijurisdictional Fuel Reduction and Wildfire Prevention Strategy.

The estimated total of all planned vegetation and fuels management activities for the years 2011 through 2015 including other Forest Service and Community Fire Safe projects is approximately 1,100 acres of hand thinning with follow-up pile burning. Approximately 1,030 acres are planned for mechanical harvest.

Alternative 1 – No Action

Stand Composition, Structure and Density

There are no cumulative impacts to stand composition, structure and density under the No Action alternative. Current stand conditions would only be altered through time with natural changes and disturbances as well as proposed future activities.

Forest Health

There are no cumulative impacts to forest health under the No Action alternative. Current forest health conditions would only be altered through time with natural changes and disturbances as well as proposed future activities. The other vegetation and fuels projects described under Foreseeable Future Activities are small in scale when compared to South Shore Project treatments and do not change the forest at the landscape level.

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Alternative 2 – Proposed Action

Stand Composition, Structure and Density

Cumulative effects of Alternative 2 would be the addition of acres to the areas already treated from past projects, as well as the acres proposed for treatment in the future. Cumulative effects would be an increase of areas with low stand densities, fewer small understory trees, and less of the undesired species such as white fir and lodgepole pine.

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, the cumulative total when adding past activities and other planned projects, is summarized in Table 3-27, this.

Table 3-27. Total Acres of Past and Proposed Activities in the Project Area

Activity	Alternative 2 (acres)	Analysis Area Total (acres)
Hand Thin	4,942	12,625
Pile Burn	4,887	20,875
Under Burn	850	6,507
Mechanical Thinning	5,728	16,077
Mechanical Chipping or Mastication	2,480	12,528
Hand Lop and Scatter	198	1,675
Helicopter Yarding	0	849

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. Approximately 7.7 miles of road construction is also proposed under the Angora Fire Restoration project.

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

The added number of acres treated would result in greater number of areas where healthy forest conditions exist. Thinned stands would increase overall forest health by removing damaged and diseased trees and favoring retention of trees with well developed crowns indicating better overall growth and ability to 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.

Alternative 3 – Preferred Alternative

Stand Composition, Structure and Density

Cumulative effects of Alternative 3 would be the addition of acres to the already treated areas from past projects, as well as the acres proposed for treatment in future 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, the cumulative total when adding past activities, and other planned projects, is summarized in Table 3-28.

Table 3-28. Total Acres of Past and Proposed Activities in the Project Area

Activity	Alternative 3 (acres)	Project Area Total (acres)
Hand Thin	5,961	13,644
Pile Burn	5,217	21,205
Under Burn	774	6,431
Mechanical Thinning	4,151	14,500
Mechanical Chipping or Mastication	2,617	13,665
Hand Lop and Scatter	170	1,647
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. Approximately 7.7 miles of road construction is also proposed under the Angora Fire Restoration project. 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 is in Alternative 2, the added number of acres treated would result in greater number of areas where healthy forest conditions exist. 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.

Analytical Conclusions

This section provides a brief summary of the conclusions of the effects analysis for forest vegetation. It provides linkage from design features in Chapter 2 to the magnitude, scope, and intensity of the environmental effects for forest species composition, stand structure and cover, and forest health from project activities.

Under the No Action Alternative, shade-tolerant white fir and incense cedar would continue to increase and crowd out pine species. The resulting increase in basal area and stand density would both increase ladder fuels and increase competition for water, nutrients, and sunlight. Trees under stress from competition show increased mortality from drought, insects, and disease. Lodgepole pine and other conifers would continue to encroach on riparian areas, and aspen stands and increase the risk of damage from wildfire. Alternative 1 would continue the current decline in forest health.

Both of the action alternatives are designed to promote forest health. Over-crowded stands would be thinned to a sustainable MSDI that would reduce inter-tree competition for light, water, and nutrients. The remaining forest would display increased resistance to insects and disease and greater tolerance to drought. Preferential retention of Jeffery pine would increase fire resistance and help restore historic species composition. Retention of the larger trees without adjacent ladder fuel from small trees would increase resistance to wildfire throughout the project area. Conifer removal in aspen stands would be sufficient to encourage aspen regeneration, increase the health of these stands, and prevent loss of aspen stands at risk on 290 acres of aspen for Alternative 2 and 251 acres for Alternative 3. The result of increasing the health of aspen stands is to increase the vegetative diversity in the South Shore project area. For both action alternatives, the removal of encroaching conifers from riparian areas reduces fire risk to these sensitive areas and encourages riparian vegetation with greater value for streambank stability.

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)).

Geology and Soil Resources

Geology

Scope of the Analysis, Indicators and Indicators of Effect

Geology provides the mineral components of soils and influences the flow and distribution of water on the landscape. Indicators of geologic factors that may influence or impact project activities would include: steep slopes, unstable soils, presence of high water tables, and landslides.

Existing Conditions – Geology

The Lake Tahoe area lies within a basin that was created by parallel faults with a roughly north-south general direction. The basin is formed by the faults which lower part of the terrain relative to areas that are uplifted.

Graben is the geological term for the lowered part of the terain, and the uplifted part is called a "horst." Graben is German for ditch.

Horst is a German word with no English language equivalent; in general terms it means an uplifted hill. These fault-created basins are common in Nevada, as well as portions of southeastern Oregon and southern Idaho.

This geographical area is referred to as the "Basin and Range Province." The *range* component of the Lake Tahoe area includes the mountains to the west and east of the lake, while the valley and Lake Tahoe itself form the *basin*. The Lake Tahoe area is very active geologically with basin and range style faulting and steep slopes where landslides and snow avalanche chutes are commonly found.

In the most recent geologic past (less than two million years) the Lake Tahoe area also had volcanic activity. This is not uncommon in basin and range style fault zones. However, the probability of future volcanism occurring in the Lake Tahoe area is very low.

Environmental Effects – Geology

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under Alternative 1 (No Action) there would be no direct or indirect increase to geologic risk because there would be no ground-disturbing activity. Because there would be no direct or indirect effects, there would also be no cumulative effects. A severe wildfire could increase the potential for mass movement due to vegetation removal.

Alternatives 2 and 3

Direct, Indirect and Cumulative Effects

Areas with a high geologic risk, as defined within the geologic hazard/risk study completed by Koler and Curren (2008), are not common in either of the action alternatives (see tables below).

High risk areas are found only in the hand thin activity areas. In their study, Koler and Curren showed that high risk areas were usually confined to hillslopes with a slope gradient greater than 60%.

Because no mechanical treatment activity would be allowed on slopes above a 30% hillslope gradient in the South Shore project, the geologic risk is negligible. The high risk areas identified in the analysis for cut-to-length units (small portions of stands 14, 307, 308, 309, 345) have slopes greater than 60%, which would not receive mechanized treatment.

Only hand treatments are proposed on slopes greater than 30%, which do not result in measurable ground disturbance, and would therefore not increase existing geologic risk.

Although very little of the project activity area is within the high geologic risk designation, caution would be applied when hillslopes are saturated. It is possible that under saturated conditions hillslopes with a gentle hillslope gradient (i.e., less than 30%) can become active due to management activity. In these situations activities would be postponed until operable soil conditions exist (see Chapter 2 for Resource Protection Measures).

Table 3-29. Geologic Hazard Areas for Alternative 2

Activity	High Risk (Percent of Area)	Moderate Risk (Percent of Area)	Low Risk (Percent of Area)
Road Recon.	0	39	61
Existing Temporary Roads	0	57	43
New Temporary Roads	0	90	10
Cut-to-length	<1	41	59
Hand Thin	7	83	10
Whole Tree	0	76	24

Table 3-30. Geologic Hazard Areas for Alternative 3

Activity	High Risk (Percent of Area)	Moderate Risk (Percent of Area)	Low Risk (Percent of Area)
Road Reconstruction	0	39	61
Existing Temporary Roads	0	53	47
New Temporary Roads	0	86	14
Cut-to-length	<1	43	57
Hand Thin	6	85	9
Whole Tree	0	67	33

Analytical Conclusions

The resource protection measures in Chapter 2 limit mechanical thinning operations to dry soils on slopes <30%, which would reduce the geologic hazards for the South Shore project to non-significant levels. Under either action alternative, the resource protection measures for the transportation system, as well as the placement of roads on gentle slopes would reduce hazards for landslides or mass movements well below a threshold of significant risk.

Soil Resource

Scope of the Analysis and Indicators

Law and Policy Governing the Soil Resource

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, and the National Forest Management Act of 1976,.

The LTBMU Land and Resource Management Plan (USDA FS 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 FS 2004).

The policies that guide vegetation management practices in order to sustain soil quality are found in the Forest Service Manual (USDA FS 2010).

Scope of Analysis

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 analyzes the effects of the alternatives on the soil resource. Proposed activities are discussed in terms of their effects on soil quality and soil productivity. All discussion of water quality impacts is in the hydrology analysis. Information in the soils analysis is not intended to predict water quality impacts and should not be used for that purpose.

For the no action alternative, the entire analysis area will be used to analyze the impacts of a potential wildfire. For the action alternatives, the spatial scope is limited to the vegetation treatment units and associated landings, burn areas within a prescribed burn, and temporary roads. Effects to soil productivity on system roads and trails are not analyzed because these areas are not dedicated to growing vegetation. 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, direct, indirect and cumulative effects on soils are analyzed for the treatment units, landings, burn areas, and temporary roads.

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.

Indicators

The following indicators form 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

These are the primary indicators of soil productivity that may be affected by forest management activities such as thinning, slash disposal, prescribed fire, and road construction and maintenance. Soils may be compacted by mechanized equipment traffic, thereby affecting soil porosity and hydrologic function. Erosion may result when surface soils are disturbed by mechanized equipment or hand crews; effective cover, including surface organic matter, is an indicator of erosion potential. Subsurface organic matter is generally lost through erosion, if the soil surface is not adequately protected. Severe burning most often results from wildfire, but may result from burning slash piles.

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 results in a decrease in porosity and an increase in soil bulk density and soil strength. 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, slight to moderate levels of compaction on coarse-textured soils may increase water storage, making water and nutrients available to plants throughout a longer period during the growing season (Gomez et al 2002).
- If moisture and aeration are decreased, soil organism activity may be reduced, slowing nutrient and organic matter cycling.

Soil hydrologic function is 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 through 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 at least ½ inch in diameter.

Surface erosion is the detachment and transport of individual soil particles by wind, water, or gravity. Accelerated (human-caused) 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. 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. Severely burned soils are identified by ratings of fire severity and the effects to the soil. A range of soil impacts may result: soil humus losses, structural changes, hydrophobic characteristics (water repellency) and sterilization are potential effects of severely burned soil.

The approximate temperature ranges for some heating effects are listed in Table 3-31 (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 3-31. 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 – Soil Resource

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 the project record. 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 (SEZ) 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 3-32. 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 3-32. 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
* SEZs within WT units would be treated by hand falling and endlining trees out of the SEZ.				

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 3-33). 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 3-33. 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 appendix 2 of 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 3-34.

Table 3-34. 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%	13-26	5	261
>10%	>44	7	443

The USDA Forest Service Pacific Southwest Region also uses an interagency erosion hazard rating based on site-specific observations (CA Soil Survey Committee 1989). 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 shown little to no accelerated 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.

Environmental Consequences – Soil Resource

Direct and Indirect

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 the area subjected to impacts from various activities would change by alternative. Overall, hand treatments would increase in Alternative 3, and there would be an increase in CTL treatment acres and a decrease in WT treatment acres in Alternative 3. The area impacted by temporary road construction and reconstruction of existing closed roads would decrease in Alternative 3.

Road Construction, Use, and Maintenance

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.

New temporary road construction would result in compaction of otherwise undisturbed soils.. 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. Road maintenance before and during the project would have minimal effects on porosity.

New temporary roads on soils with low rock content (generally less than 30-40% cobbles by volume) 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 to rip a temporary road would be made on a site–specific basis; roads having more than 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.

Under Alternative 3 there would be about 1.5 miles less new temporary road construction than under Alternative 2. Assuming a road width of 15 feet, this means 2.73 fewer acres of soil would be subject to compaction and loss of hydrologic function resulting from new road construction under Alternative 3.

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. Restoration of effective cover on new temporary roads when they are decommissioned would reduce impacts to soils. Decommissioning would include the application of chips or masticated material at the end of their period of use.

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. These effects would be minor because most road construction proposed in this project would not require cut and fill.

Impacts on existing temporary roads would be similar to those on new temporary roads, 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 be closed and stabilized to control surface runoff. 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. Over time, soil impacts would return to the level of designated use before the project.

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. Soil structure recovery would be a long term process, but wetting the road surface during periods of heavy use would help prevent wind erosion and subsequent air quality impacts. Road surface stabilization and drainage structures and permanent and temporary BMPs would be installed and maintained as needed to reduce soil impacts for both action alternatives.

Resource Protection Measures 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 and would not be significant.

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 existing temporary roads, because these areas are not part of the permanent transportation system. New temporary road construction would impact 2.7 fewer acres of soil and reconstruction of existing closed roads would impact about 4.2 fewer acres under Alternative 3 than under Alternative 2.

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. It would also contain more carbon and less nitrogen and other plant nutrients. 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 existing temporary 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.

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 FS LTBMU 2007). No significant difference was measured between tracked and non-tracked bulk densities in the Heavenly SEZ project (USDA FS LTBMU 2008). Thus, it is likely that slightly less than 15% of the activity area would be disturbed by CTL operations, but the severely disturbed area would be considerably less than 15% because porosity decreases would be slight on much of the disturbed area.

In WT units, impacts would be greatest on main skid trails and on landings. Soil disturbance in WT units could 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 (McNeil 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 depends on 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. The method proposed for determining operable conditions in this project (estimating soil consistence and limiting most operations to soils with moisture levels below the plastic limit) is generally accepted (McNabb et al 2001). 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 (e.g. Meeks, Daggett 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. Resource Protection Measures to minimize compaction include avoiding operation on wet soils 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 a 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 2004; 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 pre-project levels.

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 with 100-150 acres for Alternative 3 versus 150-200 acres of landings 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, with Alternative 3 having a lesser risk for negative impacts to soil porosity and hydrologic function.

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 could displace soil in the path where the logs are dragged and could 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. Resource Protection Measures to mitigate loss of effective cover include endlining material along slope contours (i.e. cross-slope) on slopes greater than 10% and spreading slash over any ruts created by endlining.. . Implementation of these Resource Protection Measures would provide adequate effective cover to reduce impacts to soils within SEZs in WT units under both action alternatives.

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. 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.

For both action alternatives 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.

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 most non-SEZ units, and on all landings. Grapple piling using a forwarder and pile burning would be used for slash disposal in a limited number of CTL units - up to 515 acres under Alternative 2 and up to 374 acres under Alternative 3. This would reduce the amount of surface cover as compared to the chipping or mastication treatment, with effects more similar to the WT treatments.

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 FS 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. The current overstocked condition of forest stands have likely resulted in forest floor accumulations that are greater than the norm for the ecotypes in the project area.

Surface organic matter would be replaced through chipping and mastication on 137 more acres under Alternative 2 than under Alternative 3. Because fewer landings would be required, organic matter disturbance and replacement by chipped or masticated material on landings would be decreased by about 50-100 acres under Alternative 3.

Hand Treatment

Effects on soil porosity, hydrologic function, effective cover, and surface and subsurface organic matter would be present on 1,019 more acres in Alternative 3 than Alternative 2. Of these, 51 acres would be in SEZs and 968 acres would be in upland areas. To reduce fuel loads to an acceptable level, more than one entry may be needed on up to 1300 acres in Alternative 2 and up to 442 acres in Alternative 3. Soil resource impacts from hand treatments would be insignificant under both alternatives.

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. In areas of hand units where slope and soil moisture do not limit mechanized access, and where road access is available, slash would be chipped and spread in the unit. This would increase effective cover in the treated areas (up to roughly 350 acres in Alternative 2 and up to 700 acres in Alternative 3).

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 and Wildfire

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 782 more acres in Alternative 3 than Alternative 2. Acres of hand piles would increase by 845 acres in Alternative 3, while acres of landing pile burns and underburning would decrease by 51 and 76 acres, respectively.

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. It is likely that these impacts would be decreased in Alternative 3 as compared to Alternative 2 due to the 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. Because underburning generally results in minor impacts to soil quality, the decrease in underburning would not result in a meaningful difference in impacts between the two action alternatives.

The potential for a severe wildfire that would significantly impact soil productivity would be slightly greater under Alternative 3 than Alternative 2, because fuel loads would be slightly higher and the potential for crown fire would be slightly higher under Alternative 3 than Alternative 2 in units where hand thinning would be implemented.

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; however, observations of past treatments indicate an estimated 5 to 15% of the treatment unit area would be covered on average by piles (Rita Mustatia; personal communication). Burn pile footprints often have a concave surface that retains water, providing an advantage to emerging vegetation.

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. 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.

In CTL units prescribed fire would be used in some meadow and aspen stands, where prescribed underburning or hand piling and burning of created down wood and activity slash (fuels) may be included in the treatment. Resource Protection Measures specific to burning piles in SEZs would limit impacts to a non-significant level. Activity slash would also be burned in some CTL units that are grapple-piled; grapple-piling would not be implemented in SEZs. Loss of effective cover from prescribed fire in WT units without underburning would be limited to the area covered by landing piles.

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 hand thinned 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.

In WT units, slash piles for burning would be located at landings. As described in the effective cover section, surface organic matter would be lost under landing piles and under grapple piles in CTL units. Landing piles would generate enough heat in some cases to burn organic matter in the upper part of the surface soil horizon as well; this impact would be less likely under the smaller grapple piles. These losses would be minimal as they 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.

Most of the studies on severe 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 impair soil productivity.

Underburning would not be likely to cause large areas of severely burned soil. Soil heating can be limited by burning when soils are moist to wet, which also may result in patchy duff consumption, reducing erosion potential (Knapp et al 2009, Busse et al 2010). 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 before the wildfire 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 Lake Tahoe Basin (Weisberg et al 2008).

It is likely that the soil would be severely burned under some hand piles. Roots, seeds and soil microorganisms would likely be destroyed in the upper part of the surface horizon. Burning hand piles sometimes get 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. Soil water repellency may begin to weaken in as little as 3 months and may persist for 1-2 years (Huffman et al 2001).

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 Resource Protection Measures (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 Effects

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 under Alternative 1.

Alternatives 2 & 3

Cumulative effects to soil productivity in the project area are reflected in the current conditions. Lingering effects from past actions are primarily compaction on closed roads and old landings and skid trails. Ongoing disturbance is primarily found on unauthorized recreation trails and access routes for sewer lines and other utilities. Compaction has been mitigated in some areas, such as landings in the Pioneer project and some decommissioned roads. Other projects, such as the STPUD B-line pipeline replacement have also resulted in localized short and long term impacts to soil productivity. Forseeable future actions in the project area include vegetation management and fuels reduction projects outside Forest Service lands, and stream restoration and transportation system improvement projects, most of which would have minor effects on soil productivity.

However, cumulative effects to the soil resource would be limited to the proposed treatment units, as discussed above. Impacts to soil productivity outside the proposed treatment units would not contribute to additive, pulsed or synergistic effects. 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. While often not readily visible on the landscape, 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 3-35). These projects are shown on Map 6. 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 combined with South Shore treatments would exceed 15% of the area in any of the treatment units.

Table 3-35. 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, which contribute to cumulative effects to the soils resource through compacted areas that are subject to erosion. Resource Protection Measures would be implemented to prevent creation of additional unauthorized trails that are not a part of the permanent transportation system. The Trails Access and Travel Management project scheduled to begin implementation in 2012-13 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, reducing 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. However, with implementation of the Resource Protection Measures and BMPs, neither Alternative 2 nor Alternative 3 would result in significant cumulative impacts to the soil resource.

Analytical Conclusions

The impact to soils from wildfire in the proposed treatment areas would be greater under Alternative 1 than under Alternative 2 or 3 because the intensity of prescribed fire is controlled, while the intensity of wildfire is not controlled in most cases. The extent and magnitude of the impacts to soil productivity from Alternative 1would largely depend on the extent of severely burned soil, which in turn would depend on the extent and severity of the wildfire. Impacts to soil porosity from wildfire would likely be less than significant; some compaction would result from operation of bulldozers and other equipment used during fire suppression; the extent of these impacts would be small. Soil hydrologic function could be significantly affected due to the creation of water repellent soil layers; this would be a short-term effect that would dissipate over a period of 2-5 years. Effective soil cover could be significantly affected, and resulting erosion could constitute a significant long-term loss in soil productivity, depending on the amount of topsoil lost from slopes. Surface organic matter could be significantly affected; losses to subsurface organic matter due to burning and suppression activities would likely be less than significant.

Implementation of the resource protection measures and BMPs (see Chapter 2 and Appendix B), in both Alternative 2 and Alternative 3 would prevent significant impacts to the soil resource Table 3-36). The extent of soil disturbance that affects soil productivity would not be of a size or pattern that would result in a significant change in production potential for the treatment units.

Decreases in soil porosity and hydrologic function would primarily be the result of compaction from the use of mechanized equipment. The magnitude of this impact would be limited by requiring equipment to operate when soils are not wet, and thus less susceptible to compaction. The extent of the impact would be limited by requiring designated skid trails and forwarder trails, and limiting the size of landings. The extent of compacted areas would not constitute a significant change in soil productivity. The extent of areas with diminished hydrologic function due to the formation of water repellent soil layers during prescribed burning would not result in a significant change in soil productivity because the extent and magnitude of this impact would be limited through design of prescribed fire operations.

Table 3-36. Resource Protection Measures and BMPs that would limit Potential Impacts to Soil Productivity (in the South Shore Fuel Reduction and Healthy Forest Restoration project)

Indicator	Relevant Resource Protection Measures	Relevant Best Management Practices
Soil Porosity and Soil Hydrologic Function	WS3, WS7, WS8, WS9, WS10 WS12, WS14, WS15 WS16, WS23,WS24, WS27, WS28, WS29, WS30, WS31, WS32, WS33, R19, R20, R21	1-5, 1-12, 1-13, 1-18, 2-3, 2-26, 5-3, 5-6, 7-3
Effective Soil Cover /Erosion	WS2, WS5, WS6, WS7, WS8, WS9, WS11, WS12, WS13, WS14 WS15, WS16, WS20, WS23,WS27, WS28, WS29, WS31, WS32, WS33, WS34, R3, R6, R4, R13, R17, R18, R20, R21	1-3, 1-5, 1-6, 1-8, 1-9, 1-10, 1-12, 1-13, 1-14, 1-15, 1-16, 1-17, 1-18, 1-20, 1-21, 2-3, 2-7, 2-9, 2-26, 5-2, 5-3, 5-4, 5-6, 6-1, 6-2, 6-3
Surface and Subsurface Organic Matter	WS5, WS9, WS12, WS13, WS14, WS15, WS16, WS20,WS23, WS27, WS28, WS33, R20, R21	1-14, 1-15, 5-4
Severe Burning	WS4, WS9, WS17, WS18, WS19, WS20, WS21, WS22,	6-1, 6-2

Effective soil cover adequate to control erosion would be provided in the CTL treatment units, on landings, and during road decommissioning by the application of chipped or masticated slash. On areas such as skid trails in WT treatment units and system roads, waterbars and other drainage structures would control erosion such that soil productivity losses due to concentrated flows from areas of bare soil would be less than significant.

Surface organic matter losses due to fuels treatments and road construction are not likely to result in significant changes in soil productivity even without project Resource Protection Measures prescribing application of chipped and masticated slash, because overstocked forest stands have likely resulted in forest floor accumulations that are greater than the norm for the ecotypes in the project area. Thus, the nutrient pools needed to support native vegetation would not be diminished to levels that would significantly affect productivity. Subsurface organic matter losses would be largely limited to removal of topsoil during construction of temporary roads. This would be a long-term impact, but the limited extent would render it less than significant.

Severely burned soil could result from prescribed fire, but is not expected to result from underburning or allowing fire to creep between slash piles. Some severely burned soil is likely to result from the burning of large landing piles. Limited areas of severely burned soils may be present under some hand piles and grapple piles, but the extent would be limited by Resource Protection Measures, especially those applicable to the burning of piles in SEZs. The extent of severely burned soil would be minimal; this impact would be less than significant.

The Resource Protection Measures (Chapter 2) include rehabilitation of all roads and landings to mitigate soil disturbance for all mechanically treated units, both CTL and WT units. The result would ensure that impacts remain below a significant level.

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.

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Water and Riparian Resources

Scope of the Analysis and Indicators of Effect

Scope of the Analysis

The analysis boundary for the South Shore Project includes 21 United States Geologic Survey (USGS) designated Hydrologic Unit Code (HUC) watersheds at the 7th field level (i.e., HUC7) (Map 10). HUC watersheds are a standard designation of watershed boundaries based on their relative size. HUC7 watersheds (between approximately 3,000 and 10,000 acres) are commonly used for NEPA analyses in this area because this watershed size has been shown to be large enough so that effects are not disproportionately magnified or segmented and missed entirely, and is small enough so that effects are not unrealistically diluted.

Watershed is the term used throughout this section and refers to the HUC7 watersheds within the South Shore analysis area.

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 Lake Tahoe. Most of the private lands are developed into residential communities, commercial areas, and roadways.

For this effects analysis, the South Shore project analysis area is defined as the outer boundary of all HUC7 watersheds in the south shore, and the South Shore Project area is defined as the proposed treatment acres. There are 18 HUC7 watersheds where project activities would occur and which drain into Lake Tahoe that were included in the effects analysis for the South Shore project. Two of the watersheds in the project boundary, Heavenly Valley Creek and headwaters of the Upper Truckee River, have no treatments in either action alternative, and therefore were not included in the effects analysis. 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 HUC7 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.

Several terms are used throughout this analysis section that may warrant explanation. For the purposes of this analysis, the definitions of these terms are assumed to be as follows.

Stream Environment Zones (SEZs) are defined by TRPA and the Lahontan Water Board of California as biological communities that owe their characteristics to the presence of surface water or a seasonally high groundwater table (State of CA 2005).

The criterion for defining SEZs includes indicators for vegetation, hydrology, and/or soil type. For South Shore Project planning and analysis 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. For comparison, Map 11 displays SEZs in the South Shore analysis area based both on 1B soils and on the riparian vegetation GIS layer.

Riparian Conservation Areas (RCAs) are defined by the Sierra Nevada Forest Plan Amendment (SNFPA, USDA FS 2004b) surrounding streams and other aquatic features. The RCA width is only dependent on the stream or feature type (e.g., perennial, intermittent, ephemeral) and is not defined by the soils or vegetation present in the area.

Riparian is defined as vegetation or habitat associated with a river or other water body. Riparian areas are the streamside areas that act as a transition from the upland to the watercourse. Floodplains are the relatively flat surface adjacent to streams that are flooded regularly at high channel flows. Floodplains may be, but are not always, meadows. Meadows are SEZs that primarily consist of grasses and sedges, and may or may not be associated with a stream channel (e.g. could be surrounded by forest vegetation, influenced by localized high groundwater).

Indicators

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.

Indicators of both the current conditions and activity effects to water and riparian resources are complex, and will be discussed individually. The specific indicators for water and riparian resources are linked to aquatic management strategy (AMS) goals (SNFPA, USDA FS 2004b).

Indicators for the water and riparian resources analysis include: 1) watershed condition, 2) stream channel condition, 3) water quality, 4) beneficial uses, and 5) SEZs, floodplains, and aspen stands. These indicators were evaluated using the measures described in the following sub-sections. Primarily GIS layers, technical reports prepared for other projects in the analysis area, and field reconnaissance was used to evaluate the current conditions and proposed activity effects on these indicators. The discussion of each indicator below contains a description of the existing conditions followed by an analysis of the effects of each alternative on that indicator. The cumulative effects discussion for water and riparian resources follows the individual indicator discussions, and concludes with the cumulative watershed effects analysis (CWE) and overall analytical conclusions.

Background

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. Because most of the precipitation in this area is snow, spring snowmelt contributes the majority of the streamflow throughout the year. Rain-on-snow events are infrequent, but can dramatically affect the landscape and stream channel conditions within the project area. For this reason, rain-on-snow events can contribute disproportionate amounts of pollutants to surface waters and to Lake Tahoe.

Within the South Shore project area there are 6,255 acres of RCAs and 732 acres of SEZs (see definitions above). Map 11 displays the SEZs in the South Shore analysis area based both on 1B soils (which was used for project planning and analysis) and on the riparian vegetation layer for comparison and to illustrate areas of overlap. Because both of these methods for determining SEZ locations and size have inaccuracies that may over- or under-estimate actual SEZ acres, the final SEZ designations for South Shore project implementation will be made based on field verification of SEZ indicators.

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 these excessive fuel loads is that SEZ areas within fuel treatment projects have not had adequate fuels reduction, due to strict limitations for ground-based equipment operations in SEZs. The primary treatment in SEZs in recent years has been by hand crews, limited to removing trees only up to about 14 inches in diameter. Hand thinning in these areas has often not been able to successfully meet fuel reduction goals, leaving hazardous fuel loads remaining after treatments because a substantial amount of standing and dead material greater than 14 inch diameter is still present. The result is that SEZs in the project area with no past fuel reduction treatments, and many SEZs that have only been thinned by hand crews, are now identified as wildfire hazards 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 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), the Celio Ranch project (Goldberg 2006), and the Roundhill SEZ Project (Loupe et al, 2011). Detailed information about the results from the HSEZ and Roundhill SEZ monitoring efforts are available below in the Water Quality and SEZ, Floodplains and Aspen Stands sections of this Chapter and in the Water and Riparian Resources specialist report (located in the project file). The HSEZ and Roundhill SEZ project monitoring results showed that mechanical treatment of SEZs with CTL forwarding and harvesting technology could be safely implemented under favorable soil 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; Loupe et al. 2011).

Overview of Treatments in Watersheds by Alternative

The water and riparian resource effects were analyzed specific to the individual watersheds where treatments would occur under each of the action alternatives. The table below discloses the distribution of acres to be treated under each alternative by watershed for background information.

Table 3-37. Treatment Acreage for HUC7 Watersheds in the South Shore Project Area

HUC7 Watershed Name		Alternative 2			Alternative 3		
	Drainage Area (Acres)	Hand Treat. Acres	Mech. Treat. Acres	Total Treat. Acres	Hand Treat. Acres	Mech. Treat. Acres	Total Treat. Acres
Angora Creek	3693.6	448	217	665	571	71	642
Benwood Meadow	3682.8	146	1	147	84	3	86
Big Meadow Creek	3271.0	210	171	382	275	107	382
Bijou Frontage	3763.3	239	16	256	239	16	256
Camp Richardson Frontal	2658.0	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

Note: Total treatment acres are slightly different than those presented in Chapter 2 and other sections of Chapter 3 because of the treatment acres (approximately 54 acres) that are proposed in the American River HUC7 watershed, which is outside of the Lake Tahoe Basin, and was therefore not included in the Water and Riparian Resources Analysis.

Indicator for Watershed Condition

Alternatives 2 and 3 are distinct from one another in many ways; however they do have several similarities. Throughout the following sections, the effects from Alternatives 2 and 3 are analyzed within the same subsection 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.

The specific indicators for water and riparian resources and their link to aquatic management strategy (AMS) goals (SNFPA, USDA FS 2004b) are provided first in each subsection, to provide background for the reader. The existing conditions and environmental effects for the indicators follows, with cumulative effects discussed last.

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.

How indicator was measured

- Potential for high intensity wildfire, and proportion of analysis area effected
- Additional indicator is the results from CWE analysis at the end of this section

Existing Watershed Condition

Erosion and sedimentation in the south shore increased with the onset of urbanization, and increases in human population density led to increases in the amount of 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. The dominant erosion 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 the thicker layer of soil parent material and therefore greater potential to deliver sediment.

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 ownership.

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 area indicate 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. Although several years have now passed since the fire, and much of the potential for large scale erosion has decreased, 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.

Environmental Consequences – Watershed Condition

Direct and Indirect

Alternative 1 – No Action

With the No Action alternative, the watershed conditions in the South Shore project area would not be changed. Riparian areas and SEZs in the project area would continue to exhibit degraded conditions 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 riparian areas and SEZs in the South Shore project area 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 project area could be at risk of a high severity wildfire under Alternative 1, as described previously in the Fire and Fuels section of this Chapter. A high intensity wildfire would likely result in complete loss of vegetation and ground cover in riparian areas, SEZs and uplands. The effects this would have on watershed condition would depend on the extent of the high intensity fire, and may include decreased buffering capacity of transition zones between the land and water, large erosional events if precipitation occurs soon after the fire, and the associated potential loss of soil organic layers, exposing mineral soil and hindering and/or prolonging revegetation and recovery of burned areas.

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 either action alternative would reduce the threat of high severity wildfire considerably in comparison with the No Action alternative (see Fire and Fuels section of this chapter for more details). Therefore, both Alternatives 2 and 3 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. In addition, project resource protection measures (Chapter 2) would prevent adverse effects to watershed conditions. Additional information about watershed effects is discussed in the Cumulative Watershed Effects section below.

Indicator for 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.

How indicator was measured

- Stream channel crossing condition, and associated sediment delivery issues
- Channel bank stability

Existing Stream Channel Condition

In general, erosion rates from alluvial lands are higher in the South Shore area than they were historically due to chronic, widespread, slow streambank 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 banks. 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). Unstable stream channel segments are characterized by unprotected banks that have little resistance to erosion provided by bedrock and boulders, rooted woody or herbaceous vegetation, or embedded coarse woody debris. In some cases these banks are actively eroding.

Stream channel conditions will be discussed in two groups due to the highly variable conditions in the South Shore project area:

Upper Truckee River drainage covers the 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 Upper Truckee River drainage is the largest drainage area 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; gravel mining; 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 affect hydrologic function. Effects of these historic land use impacts are multiple. Channel straightening and deepening has decreased the occurrence of overbank 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 degraded channel sections often 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 had more influence.

While these impacts have resulted in degraded channel conditions in some locations, there are also portions of each stream channel in the Upper Truckee River drainage area 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 recently 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, decreased stream bed and bank erosion, increased the potential for water quality improvements as water passes through restored reaches, and resulted in attenuated peak flood flows (i.e., reduced and more spatially distributed).

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 stream channel condition section. Taylor Creek and Tallac Creek are discussed below.

Taylor Creek is the largest of the HUC7 watersheds in this portion of the South Shore project area. Taylor Creek drains approximately 18.4 square miles at its outfall to Lake Tahoe, and includes the area draining into Fallen Leaf Lake. Tallac Creek drains approximately 4.6 square miles, and its tributary Spring Creek drains another 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, but there is evidence of unnatural aggradation (i.e., 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 disturbances such as 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 be generated by 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 seems to come from debris flows and channel erosion in the headwaters, and most of the fine sediment seems 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 channel 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, various 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 by improving functionality of channel floodplains, attenuating peak flows, increasing sediment deposition, and decreasing bank erosion as water is transported through restored channel reaches.

Environmental Consequences – Stream Channel Conditions

Direct and Indirect

Alternative 1 – No Action

Stream channels in the South Shore analysis area exhibit a variety of conditions, as described above. While portions of stream channels in the analysis 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 would not change under the No Action alternative, with the exception of possible positive effects of the previous and current restoration activities not related to the South Shore project. In addition, all existing channel crossings would remain in place, including those that are not functioning properly and/or acting as sediment conveyance barriers.

Alternatives 2 and 3

Chapter 2 details resource protection measures 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 or lakes and ponds. For example, trees would be retained within five feet of channel banks to protect channel bank stability and to maintain channel shading (Chapter 2, resource protection measure AR-2). Also, existing coarse woody debris in stream channels would be avoided to retain coarse woody debris at desired levels for stream shading and aquatic habitat (see Aquatic Wildlife section of this chapter for more details). 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 (Appendix C). Damage to stream channels would be prevented also by restricting end-lining or mechanical equipment from a minimum of 25 ft from perennial or intermittent stream channels.

Implementation of the South Shore Project proposes replacement of three existing stream crossings that are currently acting as sediment conveyance barriers, sediment sources, and/or fish passage barriers. One of these is on an intermittent channel in the Lower Trout Creek watershed, the second is on an ephemeral channel in the Cold Creek watershed, and the third crossing is on a perennial channel in the Osgood Swamp watershed. The detailed description of these crossing replacements, including expected dewatering and diversion needs are provided in the Chapter 2 Project Description.

These are the only existing channel crossings that are not functioning properly and are water and sediment conveyance barriers that have been identified in the project area. Upgrading these crossings would improve watershed connectivity in these areas and would reduce the delivery of sediment and pollutants from the existing degraded crossings to downstream areas and possibly Lake Tahoe. 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 in the long-term.

Stream crossings on temporary roads for South Shore project implementation include temporary crossings on ephemeral channels, and one temporary crossing on an intermittent channel (Chapter 2). Culverts and stream crossings would be installed to permit water flow and fish passage (where applicable). Installation and removal of 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 temporary drainage crossings would be constructed and removed when the channels are either dry or not flowing, negative effects are not expected from these temporary stream crossings.

One temporary crossing on an intermittent channel in Saxon Creek watershed would need to stay in the channel over winter and would therefore require specific installation criteria. Installation and removal of the crossing would occur when the channel is dry to avoid the need for dewatering. A filter fabric would be installed first, for ease of removal and to prevent loss of fill material to downstream areas. Then, a culvert will be installed of sufficient size to pass the winter and spring flows without causing accelerated flow downstream (approximately 18-24” diameter). Finally, rock will be used instead of dirt to fill in behind the culvert, again for ease of removal and to prevent sediment delivery to downstream areas (Appendix B). Pea gravel will be used immediately adjacent to the culvert to protect its integrity, with the rock material to be placed over the pea gravel. Installation and removal of this crossing could result in some localized soil displacement and loosening; however, resource protection measures and BMPs would protect the stream channel and surface water quality from being degraded during installation and removal of the crossing and no long-term negative effects from this temporary stream crossing are expected (see Chapter 2, Project Description for further details on temporary stream crossings).

While some localized, short-term effects from fill removal and construction associated with temporary and permanent crossings are possible, they are expected to be minimal with the application of project resource protection measures and BMPs (Chapter 2; Appendix B). In addition, because the South Shore Project would improve the condition of three permanent channel crossings and the channels adjacent to them, a reduction of erosion and sediment delivery in these channels is expected for the long-term. The South Shore Project activities would also help restore groundwater table elevations in treated riparian areas and may improve the condition of riparian channel corridors by reducing the density of encroaching conifer vegetation, which could improve base flow conditions and bank stabilization in the long-term. This project would not otherwise affect existing stream channel conditions. No long-term negative effects to stream channels are expected with the treatments for Alternatives 2 or 3, and any short-term effects from crossing installation and removal would be mitigated through application of BMPs and resource protection measures, which specify that crossings would be installed and removed when channels are not flowing, that channel bed and bank disturbance would be avoided and that banks would be restored to pre-existing conditions.

Indicator for 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.

How Indicator was Measured

- Potential for sediment delivery to surface waters
- Road density within and outside of RCAs
- Number of landings within RCAs

Existing Conditions – Water Quality

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) was recently finalized for Lake Tahoe which identified various pollutant sources and their importance for the Lake's clarity. Identified sources include but are not limited to: urban development, dirt roads, particulates in the air from winter road sanding, and stream bank erosion. National Forest lands have not been identified as a large contributing pollutant source per acre in the TMDL development process. Although approximately 80% of the Lake Tahoe Basin is "forested upland", this land use is not a large source of primary pollutants to Lake Tahoe. Land management activities within the forest uplands are anticipated to reduce the basin-wide fine sediment particle load by only approximately 1% (CA 2010). A primary pollutant of concern for Lake Tahoe's clarity identified by the TMDL efforts is fine sediment (i.e., sediment particles <16 µm). The potential for sediment delivery and water quality effects are discussed in general below, however, the fine sediment component has also been considered and is addressed with project resource protection measures and BMPs.

Because of the prized clarity of Lake Tahoe, several stringent water quality limitations have been identified for the Lake Tahoe Basin by the Lahontan Water Board and TRPA. The discharge limitations to surface waters presented in Table 3-42, below, are identified in either one or both of the Lahontan Basin Plan (State of CA 2005) and the TRPA Code of Ordinances (TRPA, 2004). 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 3-38. 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 above Meyers, 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 would 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, several waterbodies within the South Shore project area are listed as impaired for sediment/siltation, nutrients (e.g., nitrogen and phosphorus), chloride, metals (e.g., iron), and/or pathogens. Concentrations of nutrients, chloride, metals, and pathogens in surface waters are not expected to be negatively affected by the South Shore Project activities and therefore are not discussed further. The waterbodies listed for sediment/siltation (Heavenly Valley Creek and Lake Tahoe) have the greatest potential to be affected by the South Shore Project, and therefore the mitigation and resource protection measures proposed to avoid any effects to sediment concentrations in surface waters are discussed in detail below.

The south shore community contains 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, installation and maintenance of BMPs on unpaved roads, trails and landings, and utilization of innovative ground based equipment for forest treatments have been identified as having the greatest potential to efficiently reduce loading from forested areas in the Tahoe Basin, especially if conducted at the same time as planned forest management treatments (CA 2010). In addition, the USFS was credited in the TMDL Pollutant Reduction Opportunity report with effectively limiting ground-based equipment operations to low slope areas, with deep soils and high infiltration capacities, and with restricting whole-tree operations to the most-accessible, resilient areas (CA 2007).

The LTBMU recently completed BMP upgrades on roads throughout the Lake Tahoe Basin that were identified as contributing to sediment delivery or erosion issues in order to reduce the conveyance of road-borne sediments into streams and the associated water quality impacts. All roads in the basin were evaluated for their level of risk, including whether they needed BMP upgrades to correct an erosion or sediment delivery source, and for their proximity to surface water features. The actions taken with the BMP Retrofit Program included decommissioning or obliterating unnecessary roads where appropriate, converting selected roads to trails, and upgrading Forest roads with applicable BMPs where necessary. In the South Shore analysis area, BMP retrofits and road upgrades 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, BMP Evaluation Program (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 in the south shore of the Basin were rated as effective (Briebart et al 2007). Finally, 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 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).

There has also been a large push in recent years to address urban stormwater runoff because of its contribution to the decline in lake clarity. Therefore, local jurisdictions, including El Dorado County and the City of South Lake Tahoe, and state and federal agencies such as the California Tahoe Conservancy (CTC) and the LTBMU have been rigorously addressing urban stormwater and runoff problems throughout the south shore region. Numerous urban erosion control projects have been completed in the South Shore analysis area in recent years. These erosion control projects serve multiple benefits for urban water quality including sediment source control and stormwater 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.

An additional existing impact to water quality from Forest Service managed lands within the South Shore Project area includes the effects of the Angora Fire. The boundary of the Angora Fire, which burned through portions of the South Shore Project area in June and July of 2007, overlaps five of the HUC7 watersheds within the project area. The watersheds affected by the Angora Fire within this analysis area include Angora Creek, Camp Richardson Frontal, Lower Upper Truckee River, 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, several years have passed since the Angora Fire, and the risk for large scale sediment delivery from the burned area has been greatly reduced. Nonetheless, in the hotter burn areas where the seed source is less, the potential for erosion will be accelerated until natural vegetation reoccupies these areas in the next several years (Weaver et al., 2007).

Finally, forest floor organic material (litter) has accumulated in forested areas in this region considerably in the absence of frequent fire. This has been more dramatic in the 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 in 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).

Environmental Consequences for Water Quality

Direct and Indirect

Alternative 1 – No Action

In the absence of wildfire, the No Action alternative would not affect current water quality conditions. However, given the greater likelihood that a high intensity wildfire would occur in south shore if fuel loads are not reduced in the area, there is a greater potential for water quality degradation from a wildfire 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 and USGS 2004). Furthermore, nutrient mobilization after wildfires from smoke and ash can also contribute to water quality degradation.

The accumulation of Forest floor organic material (litter) in forested areas would continue in the absence of fire. The existing thick organic horizons in Tahoe Basin soils would continue contributing nutrients to forest runoff and may act as a nutrient source to nearby surface waters (Miller et al 2006, Loupe et al 2007). The No Action alternative would not change the rate of accumulation of organic material on the forest floor, nor would it reduce the potential organic nutrient contribution from forest runoff.

Standard road maintenance activities and BMP upgrades to facilities on National Forest lands would continue under the No Action alternative. These activities help to reduce the water quality impacts associated with improper drainage from National Forest System (NFS) roads and facilities, and therefore would reduce the related impacts to water quality.

Alternatives 2 and 3

Although the proposed ground based equipment operations may result in localized increases in erosion potential due to some soil disturbance and compaction, South Shore project activities are not expected to increase the delivery of sediment to surface waters above background levels because of several mitigating factors: 1) the limited disturbance extent, 2) the restriction for most mechanical treatments to occur under operable soil moisture conditions, 3) the prescribed buffers between treatments and surface water features, and 4) the application of the SEZ Sensitivity Rating System to determine suitability of SEZ units for mechanical equipment operations (Appendix C). For additional information about the effects of proposed treatments on soil conditions, refer to the Geology and 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 (a measure of soil permeability) of 20%, which was not found to be statistically significant, and a 2.5% reduction in soil bulk density (Christensen and Norman 2007), still well below the 10% threshold from 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 thus more susceptible to compaction and displacement. A soil quality monitoring effort was also recently completed in the Roundhill Project area, which is characterized by similar soil conditions as present in the South Shore project area. The monitoring results indicated no change in hydraulic conductivity or bulk density values resulting from upland project treatments (Loupe et al. 2011). 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 (due to the different soil textures present), and similar impacts to those experienced in the Roundhill Project. Although water quality was not directly measured for these monitoring efforts, saturated hydraulic conductivity, bulk density, and soil cover were used as indirect measures of water quality effects. In addition, treatment techniques that involve thinning, and leave at least 50% of the forest canopy, such as CTL methods, have been shown through modeling and paired watershed studies to have little or no effect on runoff at the watershed scale (Litschert and MacDonald, 2009). Based on these findings, proposed South Shore CTL operations in upland units are not expected to result in impacts to soil or water quality, or to erosion potential.

The HSEZ and Roundhill SEZ fuel reduction projects described in the background section above were implemented in late summer of 2007 and late summer of 2009, respectively. Both projects utilized low ground pressure (i.e., 6 psi alone or 13 psi fully loaded) mechanical equipment (Cut-To-Length [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 both studies demonstrated that the CTL mechanical operations resulted in a measured decrease in saturated hydraulic conductivity (Norman et al. 2008, Loupe et al. 2011). However, in both cases, 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 and runoff (Norman et al. 2008; Loupe et al. 2011). In addition, there was no statistically significant difference between pre- and post-project soil bulk density values for either project. Finally, the measured reduction in soil cover was well within the range of acceptable soil cover set forth in the USFS Region 5 soil quality standards (USDA FS 2004a).

Based on these findings, the Lahontan Water Board, TRPA and LTBMU staff agreed that other fuel reduction stands containing SEZs could be treated with similar mechanical equipment and resource protection measures (e.g. 25 ft buffer for perennial and intermittent streams and soil moisture requirements) without impacts to soil and water quality if they are equally or less sensitive than the HSEZ site. For this reason, a sensitivity rating system was developed by LTBMU staff to evaluate SEZ sensitivities to ground based equipment operations (Appendix C). This system was designed to evaluate whether or not ground based mechanical equipment could perform the fuel reduction work needed in stands containing SEZs without the risk of adverse effects to soil or water quality in or near the SEZ. With the use of this rating system, and application of project resource protection measures and BMPs, adverse effects to water quality from mechanical treatment in SEZs are not expected.

Whole-tree (WT) treatment operations have not previously been monitored for soil and water quality impacts in the Lake Tahoe Basin, and therefore present some uncertainty about the level of potential impacts. Increased erosion potential and slightly altered hydrology may occur in WT treatment units. Protection of surface water features and prevention of impacts to soil and water quality are provided by larger equipment exclusion buffers for whole-tree units than for CTL operations based on soil cover and slope (Chapter 2, resource protection measures). When compared to CTL, WT thinning operations require the creation of skid trails and typically larger landings, which makes these treatment units more prone to exposed soil areas and soil displacement. Skid trail and landing rehabilitation measures would prevent or mitigate potential long-term effects of this disturbance. The risk of on-site erosion from all tree removal activities is reduced by project resource protection measures (Chapter 2) and Forest Service BMPs (Appendix B). In addition, monitoring for this project would ensure that prescribed BMPs and resource protection measures are properly installed and functioning (see Chapter 4). The resource protection measures and BMPs primarily function as source control measures (i.e., controlling the source of potential erosion and sediment delivery) and therefore are designed to prevent erosion, including that of the fine sediment fraction (i.e., particles <16 µm). The application of project resource protection measures and BMPs will prevent sediment delivery to surface waters and avoid causing any measureable effects to water quality, such as detectable increases in turbidity.

The proposed buffers for stream channels in the CTL and WT treatment units are intended to prevent sediment delivery to surface waters. Buffers that exhibit surface roughness features and restrict mechanical equipment from close contact with water bodies reduce impacts below significance by allowing infiltration of flows and trapping sediment before it is delivered to surface waters (Litschert and MacDonald, 2009). The prescribed buffers for the South Shore Project were determined based on successful results from the HSEZ and Roundhill SEZ projects and on experience with CTL and WT treatments and the associated potential impacts, and are largely supported by the literature (Rashin et al., 2006).

Pile burning and underburning are additional activities proposed with this project. The potential for effects to SEZs, floodplains, and aspen stands are addressed under that section of this chapter. Pile burning and underburning are not expected to affect water quality through the convective transport of ash and particulate matter. The current practice for pile burning in the Lake Tahoe Basin is to allow piling and burning up to 50 feet from perennial and intermittent stream channels, and outside of SEZs. Piling at this proximity to stream channels has not resulted in ash or particulate delivery or delivery of piled material to surface waters in the past; therefore, effects to water quality from these treatments are not anticipated for this project. Any ash that may be transported to surface waters would be in such small quantities, and spaced out temporally, that it would be negligible and would not increase turbidity levels or otherwise pose a risk to water quality. Because this project involves piling and burning material in SEZs outside of the 50 ft piling buffer, there is a monitoring element for these treatment areas which would include assessing the potential for water quality effects (Chapter 4).

In some instances, machine piling with a grapple attachment would be conducted in CTL units. In these units, grapple piling would occur rather than masticating/chipping and would not result in any additional equipment passes through the unit. This treatment would be applied in units that are in close proximity to main roads or facilities, where masticating/chipping the material could result in property damage. The machine piles may be larger than typical hand piles, so would be prohibited in SEZs. Units that are machine piled rather than masticated/chipped after initial CTL treatment would have less ground cover remaining after implementation, because the slash material would be piled and burned rather than left on site and masticated/chipped. Although less ground cover would result, ground cover would still be greater than in WT treatment units, and would be adequate to prevent erosion. The maximum number of acres that would be treated with machine piling rather than mastication/chipping after CTL thinning would be 515 acres for Alternative 2 and 374 acres for Alternative 3.

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 would not affect existing sediment concentrations in Heavenly Valley Creek. Only Lake Tahoe itself is listed for sediment/siltation and would also overlap with South Shore project treatments. The project has been designed to reduce the potential for sediment delivery to waterbodies, as described below. Through application of project resource protection measures and BMPs, sediment delivery to Lake Tahoe would be avoided.

In addition, only one of the 5 watersheds in the South Shore analysis area that were 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. However, South Shore Project activities are not expected to negatively affect concentrations of nutrients or metals in surface waters.

Overall, sediment delivery resulting from increased erosion would be avoided with this project. The potential for increased erosion exists from concentrated use areas such as landings, temporary roads, stream crossings, and skid trails. Sediment delivery would be avoided through application of project resource protection measures and BMPs (Chapter 2, Appendix B), and water quality effects would not be measureable when considering background conditions. In addition, soil cover would be maintained in treatment units to reduce erosion potential except where skid trails exist and during the use of landings and temporary roads. These areas comprise a very small portion of each treatment unit (<15%, see Geology and Soil Resources section of this chapter), and an even smaller proportion of each watershed. Also, 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, resource protection measures). Furthermore, landings and skid trails would not be permitted within SEZs in this project, and temporary roads would be very limited in SEZs. Therefore, these project activities are not expected to result in increased sediment delivery to live channels or to affect background sediment concentrations or turbidity levels in surface waters in the project area.

Project activities are not expected to negatively influence nutrient concentrations in surface waters; however, in the long-term, decreased nutrient concentrations in forest surface runoff may result. For example fuel reduction and thinning activities would 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 2009). Even where project activities do not decrease the depth of organic forest floor material directly, they would 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 2009). Chip and masticated material typically exhibits higher carbon to nitrogen ratios than forest litter, and therefore is more difficult and takes longer to decompose. Consequently, microbes would utilize (i.e. take up) N and P for longer periods of time for decomposition of chipped and masticated material compared to litter, and would take much longer before releasing these nutrients into surface runoff.

Road related erosion is typically the primary source of existing accelerated erosion in forested areas, particularly at channel crossings. However, the action alternatives would improve the condition of three channel crossings in the project area (described in detail in the Project Description in Chapter 2), resulting in a reduction of sediment delivery in these channels over the long-term. In addition, project resource protection measures and BMPs would 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 a measure of the level of road impacts in the project watersheds. The Forest Plan has no standards for this measure of watershed risk, but an upward trend in these attributes would indicate higher levels of risk. Alternative 2 would involve constructing 4.8 miles of new temporary roads, and reconstructing 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 road segments to act as sediment sources during and immediately after implementation. Either action alternative would avoid altering the hillslope hydrology by outsloping new temporary roads and constructing them to follow the rise and fall of the land. All temporary roads utilized during the project would be decommissioned as described in the resource protection measures (Chapter 2) to minimize the potential for sediment delivery to waterbodies and other potential effects to water quality, such as increased turbidity.

The miles of NFS roads within the South Shore analysis area are more directly linked to project affects 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 roads with other ownerships (State, county, city) 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 3-39 below, with the resulting road density for each watershed. The road densities are compared in Table 3-39 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.

The watersheds with no treatments also do not contain any temporary roads that would be used in the South Shore Project. The existing road density in these two watersheds (Heavenly Valley Creek and Headwaters of the Upper Truckee River) will not be affected by the South Shore Project activities, and are not included in Table 3-39.

Table 3-39. Forest Service Roads and Road Density in the South Shore Project Area Watersheds

Watershed Name	Watershed 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 3-39, the road densities in each 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 the 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. 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. 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. 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 3-40 presents the road length within the RCA boundaries under

Alternative 1, and with proposed Alternative 2 and 3 treatments. Although approximately 60% of the South Shore Project total treatment acres are within RCAs, comparison of Tables 3-39 and 3-40 demonstrates that a substantial amount of the road network is in the upland areas, over 300 feet away from perennial 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. The potential for erosion and sediment delivery effects in this watershed are further reduced because the majority of the temporary roads are in the upland forest area.

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 watersheds that maintained the same road density for Alternative 3 as they had for Alternative 2.

It is important to note that the proposed South Shore treatments are primarily within the WUI, where road access needs are much greater than in the general forest due to residential communities, the high recreational use from forest visitors, and the access needs for fire suppression and forest management activities.

Table 3-40. National Forest Road Miles Within RCAs in the South Shore Project Area

Watershed 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**	

Landings are another potential source of compacted soils and increased erosion potential from vegetation management activities. Approximately 80% of the landings proposed for use in the South Shore project already exist on the landscape; about 20% would be newly constructed. Alternative 2 requires more landings than Alternative 3, which contributes to the additional potential for impacts associated with Alternative 2. Chapter 2 details landing locations selection 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 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 were moved out of RCAs, resulting in a greater reduction in the number of landings within RCAs. A comparison of landings by watershed is given in Table 3-41 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 slash, wood chips or masticated material to a maximum 6-inch depth to each landing. Landings would then be ditched, sloped or water bars installed as needed to disconnect the landing from surface water features. Landings would also be ripped to approximately a 12-inch depth (where soils allow and noxious weeds are not present). Finally, selected landings would be seeded with a native seed mix of grasses, forbs, and shrubs (Chapter 2).

Table 3-41. Total Number of Landings for Alternatives 2 and 3 within and outside of RCAs

Watershed 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 effects to water quality on Forest Service managed lands from the South Shore project are associated with the short-term, localized increased erosion potential 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.

Proposed South Shore Project activities are not expected to increase sediment delivery to surface waters in the project area, and measurable impacts to water quality (such as increased turbidity) are not anticipated with implementation of the prescribed resource protection measures (Chapter 2) and BMPs (Appendix B), including: limitations to placing landings and skid trails in SEZs, limiting temporary crossings to dry channel conditions; decommissioning temporary roads and landings after use; and road maintenance activities to reduce existing sediment delivery. This project would maintain the existing practices employed by the Forest Service for forest management, including standard BMPs and use of innovative ground based equipment, and would also incorporate decommissioning roads and landings to the extent feasible to comply with the Final TMDL direction (CA 2010). The potential for sediment delivery from roads and landings is further reduced for Alternative 3 than Alternative 2 by decreasing the amount of temporary road length in general and within RCAs, and by dramatically decreasing the number of landings located within RCAs.

Indicators for Beneficial Uses

How Indicator is Measured

- Number of beneficial uses potentially affected by project activities

Existing Conditions – 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 (CA 2005) 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

Environmental Consequences – Beneficial Uses

Direct and Indirect

Alternative 1 – No Action

The No Action alternative would not directly affect beneficial uses within the South Shore project area. However, the indirect effect of taking no action at this time is that the risk for effects from high intensity wildfire would remain or worsen. These risks include the potential for large scale sediment and/or ash delivery following a wildfire in the event of a large precipitation event resulting in erosion. This could affect many of the beneficial uses listed above, due to the potential for transport of this material to stream channels and even Lake Tahoe. The level of impact to beneficial uses would depend on the magnitude of the erosion event and the proximity of the fire to surface water features.

Alternatives 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 either not expected to be affected by the project at all, or are expected to be positively affected over the long-term due to the decreased number of conifers drawing from available groundwater resources, the improvements to wildlife habitat, and the protection of sensitive habitats and species associated with the South Shore project treatments. Two potential exceptions include the non-contact water recreation and cold freshwater habitat beneficial uses. For non-contact water recreation, resource protection measures for channel crossings, roads and forwarder/skidder trails, and SEZs and buffers would mitigate any potential sediment delivery impacts associated with the South Shore project (see Water Quality section for additional details) and visible increases in turbidity would not result. Since sediment delivery to Lake Tahoe is not expected to result from South Shore project activities, negative impacts to non-contact water recreation from increased water turbidity would be prevented. For the cold freshwater habitat beneficial use, stringent resource protection measures would be applied adjacent to streams to avoid adverse impacts to stream temperature and shading. Stream banks would be buffered and coarse woody debris would 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 would be closely monitored to avoid adverse impacts to cold freshwater dependent species (for more information refer to Aquatic Wildlife section in this chapter, Chapter 4, and the Fisheries BE/BA located in the project file).

These beneficial water uses would also be supported by the proposed project activities, which would 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.

Indicators for SEZs, Floodplains, 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.

How Indicator was Measured

- Acres of RCAs, SEZs and aspen stands treated

Existing Conditions – SEZs, Floodplains, and Aspen Stands

SEZs, as defined above, include several different types of features that are supported by surface or groundwater. Therefore, although SEZs, floodplains and aspen stands are addressed somewhat separately in this analysis, floodplains and aspen stands are also considered SEZs. More specific discussion is included about floodplains and aspen stands because of their unique characteristics; however, SEZ protection measures would also apply to these unique features.

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 densities of conifer species that exist in SEZs contribute to a greater risk of tree mortality due to fluctuations in the water table and increased susceptibility to insect attack. In addition, higher densities of conifers in riparian areas and SEZs 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, ground fuels and standing trees near these channels provide floodplain roughness under high flow conditions. Floodplain roughness acts to slow flood waters, dissipating energy and allowing sediment in the water to settle out on the floodplain (2ND Nature, 2011), which can result in a reduction of sediment concentrations in waters downstream. Native riparian vegetation provides additional floodplain roughness, and provides the added benefit of reducing nutrients in flood waters by absorbing and utilizing the influx of nitrogen and other nutrients delivered by floods. Utilization by native riparian vegetation reduces the concentrations of nutrients in downstream areas and also reduces the potential for these nutrients to become pollutants of concern for Lake Tahoe water clarity. However, because of the presence of, and competition from, coniferous vegetation on floodplains in the South Shore analysis area, natural floodplain roughness features in the form of riparian vegetation are in decline in many areas.

The South Shore analysis area includes approximately 1,180 acres of aspen stands. During the analysis for the LTBMU aspen community restoration project, 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, including conifer encroachment, aspen regeneration, proportion of aspen within the stand, and the occurrence and condition of understory brush and herbaceous vegetation. These evaluations were used to rate the risk of loss for aspen stands in the Lake Tahoe Basin as: 1) no risk, 2) low, 3) moderate, 4) high, or 5) highest. Using this information, 290 acres of at-risk aspen stands in the WUI and inside or adjacent to South Shore treatment units 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;
- Conifer crowns overtop aspen crowns in about 60% 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 14) located within the project area designated as special aquatic features by the LTBMU Forest Plan (USDA FS LTBMU 1988). The special aquatic feature designation includes springs, seeps, fens and bogs (USDA FS 2004). In addition, Grass Lake is a research natural area (RNA) (USDA FS LTBMU 1988) within the analysis area; however, it does not overlap with any proposed treatments for the South Shore project.

Environmental Consequences – SEZs, Floodplains, and Aspen Stands

Direct and Indirect

Alternative 1 – No Action

The current condition of SEZs, floodplains, and aspen stands in the South Shore project area would not improve under the No Action alternative (Alternative 1). Coniferous vegetation encroaching in these areas would continue to degrade their condition by out-competing wetter vegetation species for water, nutrients, and sunlight. Floodplains and meadows are likely to continue in a drying trend because conifers use more water than riparian vegetation, often drawing down the water level and lowering groundwater tables. Conifers would continue to encroach in these areas and floodplain and SEZ function would not improve. In addition, the risk for loss of aspen stands would continue or increase, and conditions would likely decline further 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 SEZs, floodplains, and aspen stands, are expected to improve stand conditions and promote the long-term health of riparian vegetation and aspen, or mixed conifer type vegetation, depending on the location. Non-coniferous riparian vegetation would be retained. Management within RCAs is projected to meet riparian conservation objectives (RCOs) (USDA FS 2004). Refer to the RCO analysis report available in the project record for more information regarding how the South Shore Project meets the RCOs.

Reducing fuel loading substantially within RCAs and SEZs would effectively reduce the likelihood of a high intensity wildfire in these areas. Implementation of South Shore Project treatments would also improve the condition of riparian areas and SEZs, including floodplains and aspen stands and meet the fuel loading objectives of the project. Standard BMPs (Appendix B) and project-specific resource protection measures (Chapter 2) would protect the soil resources and surface water features of each site where mechanical operations are proposed within SEZs and RCAs.

Measurement indicators used to evaluate the success of the action alternatives in restoring SEZ, floodplain and aspen stand function currently degraded by encroaching conifers are: 1) acres of SEZs and RCAs treated to result in improved ecological and hydrologic function; and 2) acres of aspen stands treated and restored. These measurement indicators are summarized in Table 3-42 below for both Alternatives 2 and 3.

Table 3-42. Acres of RCA, SEZ (based on 1b soils), and Aspen Treated in Alternatives 2 and 3, for Each Watershed

Watershed 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 both action alternatives are very similar, and would both result in improved conditions in treated areas. The purpose of the reduced treatment acres 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 only at acres treated for RCAs, SEZs, and aspen, Alternative 3 reduces total impacts to forest resources associated with the proposed treatments to a greater extent.

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 would be treated by hand crews. Previous hand treatments in SEZ areas have not resulted in detrimental impacts to SEZs. However, 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 boundary was achievable. The South Shore project includes piling of slash and subsequent burning within SEZs. The fuel reduction needed within South Shore SEZs is extensive enough that transporting fuels outside of the SEZ for burning or disposal is not practical and has the potential for greater negative impacts from soil disturbance than hand piling and burning these fuels within the SEZ boundaries. Based on experience from burning piles within RCAs using existing practices in neighboring Region 5 Forests, piling and burning within SEZs can be done without causing negative impacts through the application of appropriate resource protection measures. The resource protection measures developed for piling and burning within South Shore SEZs are based on examples of successful experiences in Region 5, and are provided in Chapter 2. These resource protection measures would protect SEZs, floodplains, and aspen stands by limiting the placement and spatial extent of piles to protect riparian vegetation species. In addition, monitoring of SEZ pile burning is included with this project, and is detailed in Chapter 4. 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.

Allowing piling in SEZs greatly reduces the number of passes that a crew carrying heavy slash loads would need to make through the SEZ, thereby reducing the extent of soil compaction from trampling by crews. However, because of the amount of ground fuels and live fuel loading present in some of the SEZ hand treatment units and the restrictions for piling within SEZs (Chapter 2 Resource Protection Measures), multiple entries may be necessary to achieve the desired condition. Multiple entries would be limited in extent, and would only be prescribed when current surface fuels are high and would result in fuel loads greater than the desired maximum of 15 tons per acre post treatment. Up to 1,287 acres of hand thinning treatments may require multiple entries under Alternative 2 and up to 1,729 acres may require multiple entry under Alternative 3.

The SEZ sensitivity rating system evaluation of suitability of SEZs for mechanical equipment operations (Appendix C) would reduce the potential for negative effects in SEZs from mechanical treatment. Based on the monitoring results from the Heavenly Valley Creek SEZ demonstration project (HSEZ) (Norman et al. 2008) and the Roundhill SEZ project (Loupe et al. 2011), CTL operations in SEZs determined to exhibit operable conditions based on the SEZ sensitivity rating system are not anticipated to result in adverse effects to soil or water resources. By restricting ground based equipment operations to operable soil moisture conditions (guidelines for this determination are found in Appendix D) resource damage is not expected to occur in these areas with either of the action alternatives.

Resource protection measures for WT treatment units that contain SEZs would prevent or minimize negative effects using several methods. First, WT equipment is prohibited from operating in SEZs. Hand crews would directionally fell trees toward the adjacent upland areas where mechanical equipment could end-line the material for removal. In cases where end-lining is not feasible, and for larger SEZs within WT units, hand crews would accomplish the treatments. The limbs and branches of trees to be end-lined would be lopped and scattered to provide soil cover unless desired fuel loads are exceeded, in which case slash would be piled and burned (Chapter 2).

Mastication is proposed in some hand treatment units where it would be difficult to otherwise meet desired fuel load conditions. Because many hand treatment units contain SEZs, the same SEZ Sensitivity Rating system (Appendix C) would be used to evaluate whether or not the hand treatment units that contain SEZs are suitable for mechanical equipment (i.e. masticator) operations. Where conditions are determined to be suitable for mechanical operations, mastication would be conducted in these units under operable soil moisture conditions (Appendix D). The maximum number of acres that would receive mastication after hand treatment is 353 acres with Alternative 2 and 692 acres with Alternative 3. These proposed acres have been incorporated into the cumulative watershed effects analysis (described below) for both Alternative 2 and 3, respectively.

While the proposed treatments in aspen stands may result in an increase in exposed soil, some compacted soils, and disturbance of the existing ground cover and litter layer, the long-term response of aspen to soil disturbance is positive. Reduction of conifer encroachment would increase water availability. Aspen trees are intolerant to shade (USDA FS 2006d), and would benefit from removing competing conifers. Additional sunlight would reach the soil, increase soil temperatures, and provide an enhanced growth environment for aspen suckers (USDA FS 2006d). The expected establishment of herbaceous understory vegetation would provide ground cover and result in a long term decrease in erosion. The soil disturbance caused by aspen stand treatments would benefit aspen regeneration by allowing pre-existing buds to produce additional aspen trees through sucker growth (USDA FS 2006d). Improved growing conditions would also result in greater soil cover from young aspen regeneration and annual leaf drop. 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. Existing aspen stands present in the analysis area, and the South Shore proposed aspen stand treatments are shown on Map 9.

Several special aquatic features are present within the project area. Implementation of the resource protection measures (Chapter 2) is expected to prevent or minimize the potential for negative effects to special aquatic features and the surrounding soil and surface hydrology consistent with RCOs (USDA FS 2004).

Under both action alternatives, treatments in SEZs, floodplains, and aspen stands would result in long-term benefits to these habitats by enhancing riparian vegetation through removal of competition from conifer encroachment and reducing wildfire hazard. Conifer removal would improve growing conditions in these areas for more diverse and productive riparian and wet meadow vegetation. The improved riparian vegetation growing conditions could increase water quality treatment along stream corridors, and improve habitat for riparian dependent wildlife species. In addition, removing conifer vegetation along floodplains and other SEZs would help restore natural timing, variability and duration for floodplain inundation. Conifer removal may also raise water table elevations due to a decrease in conifer water uptake and transpiration.

Potential short-term effects of the treatments in these areas include reduced floodplain roughness and temporary localized increases in erosion potential. These effects to the condition of SEZs, floodplains, and aspen stands are expected to be minimal because of the limited disturbance extent in these areas and the restrictions to treatment activities. Therefore, no adverse effects to SEZs, floodplains, and aspen stands are expected from project activities.

Cumulative Impacts

Cumulative Watershed Effects (CWE)

Analysis Methodology

Consistent with 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 (e.g., aquatic communities) are supported at the HUC7 watershed scale, and changes in the mechanism of concern (e.g., surface erosion) can be detected at this spatial scale. At larger scales, effects may be diluted. A primary assumption of this analysis is that protection of beneficial uses at the HUC7 scale also results in protection of uses at larger scales, including 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 impervious surfaces an area can tolerate before a 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 a TOC for that watershed. TOC does not represent an exact point at which cumulative watershed effects would 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 the TOC. Table 3-43 presents total watershed acres, allowable impervious acres, and TOC values as a percentage of the watershed area.

Table 3-43. 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) is a unit used to estimate the impacts of various land use activities in a watershed and relate it back to the TOC. 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 lop and scatter (Table 3-44). ERA coefficients are used to calculate existing or projected impervious cover, which is then related to the TOC for each watershed.

Disturbance from the action alternatives, current land uses, and past, present, and foreseeable future project activities were estimated within each watershed for this CWE analysis using the process recommended for the Pacific Southwest Region of the Forest Service (FS Handbook 2520, Ch 20, 1988). Past activities analyzed include previous vegetation management activities (dating back to 1990), landings, prescribed underburning, pile burning, and natural occurrences such as wildfires. Disturbance coefficients applied to each type of ground-disturbing activity were developed by watershed scientists from the LTBMU, and adapted from coefficients developed by the Eldorado and Tahoe National Forests.

Table 3-44. 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 (ripping)	0.08
Site Preparation	
Hand piling	0.005
Hand Pile Burning	0.01
Underburning	0.03
Mechanical Pile Burning	0.03
Chipping/mastication	0.035
Lop and Scatter	0.00
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 (ripping)	0.08
Ski runs	0.20
Impervious Surfaces (paved roads and buildings) – obtained from IKONOS and GIS	1.00

The coefficients shown above were multiplied by the acres of the management activity to determine the ERA for that use or activity in a particular watershed. The total ERA from all land uses in each watershed is compared to the TOC for that watershed in order to define the risk ratio for the watershed using the following equation:

Risk Ratio = Total 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 any proposed treatments and the resource protection measures required to minimize those impacts.

A straight line (linear) recovery over twenty years is modeled for ground disturbing activities such as vegetation management activities and landings. Recovery is reflected in the model by applying a recovery coefficient to each activity. A 20-year recovery was also assumed for wildfires, 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 and other project area wildfires provide a conservative estimate of the potential for disturbance and risk.

The ERA method assumes no recovery from roads that remain in use. Unlike the other disturbances listed above, the land covered by roads may not recover over time with continued use.

The ERA analysis methodology allows for a comparison of alternatives regarding the relative potential for watershed impacts from proposed treatments rather than providing a complete picture of watershed effects. 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 models this as 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. Every modeling method has inherent limitations, and Cumulative Watershed Effects analysis utilizing ERAs with a defined TOC for HUC7 watersheds is a standardized method and provides a useful comparison of effects among alternatives.

Alternative 1

By implementing the No Action alternative, the stand conditions in this analysis area would 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 section of this chapter 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.

The current condition of south shore channels will not change under the No Action alternative, with the exception of the following proposed restoration activities not related to the South Shore Project. 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 (2010-2012) – 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 (2013-2016) – LTBMU and CTC;
- Upper Truckee River, CA State Parks Reach channel restoration of 7,920 ft of channel (2012-2014) – CA State Parks;
- Angora Creek, above Lake Tahoe Blvd involves restoration of about 3,000 ft of channel, the construction dates are not currently known - LTBMU
- Upper Truckee River, Marsh Reach restoration of about 9,000 ft of channel, construction dates are not currently known – CTC;
- Upper Truckee River, Reaches 1 and 2 restoration of approximately 4,250 ft of channel, the construction dates are not currently known – CTC
- Taylor and Tallac Creek channel and meadow restoration project involves about 2 miles of channel restoration, the construction dates are not currently known – 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 construction related effects of these channel restoration projects, however BMPs and project designs will reduce and mitigate these impacts. In addition, the construction timing for the various projects has been phased to reduce the amount of channel disturbance in any given year.

In addition, urban erosion control projects are also proposed to continue into the future, which will further reduce the impacts from impervious surfaces in the South Shore analysis area. These projects often involve not only reducing the source areas of erosion and sediment, but also treating stormwater runoff for fine sediment and nutrients.

However, with the No Action alternative, there would be no South Shore project activities to produce direct or indirect effects, so there would be no additive cumulative effects from the South Shore project.

Alternatives 2 and 3

Cumulative Watershed Effects (CWE) Assumptions

For the South Shore project CWE analysis, the following assumptions were made to inform the analysis and to ensure consistency.

- All proposed treatment activities would comply with Regional BMPs and with project-specific resource protection measures. The ERA coefficients used for various management activities (Table 3-48) assume that the use of Regional BMPs is included with treatments.
- 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 3-48).
- Although the landings used for South Shore treatments would be decommissioned to some extent after project completion, the exact method for each landing decommissioning is variable, so the CWE analysis assumed the full 20 year recovery period for all landings. This applies a more conservative approach because the CWE analysis does not reduce landing impacts based on a more immediate recovery due to decommissioning.
- 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. These acreages provide a useful estimate of average landing size for each treatment type in order to compare effects between the action alternatives. Actual landing sizes would vary, with the WT landings generally larger than the CTL landings.
- Previously decommissioned roads (i.e., existing temporary roads) were given the coefficient for unpaved roads after subsoiling/ripping (0.08).
- Although temporary roads would be decommissioned after project implementation, the CWE analysis does not reduce road impacts based on recovery due to decommissioning. Therefore, for this analysis it was assumed that the temporary road construction and reconstruction effects would follow the 20 year natural recovery rate after project completion.
- 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. Many urban lots would not receive any secondary treatment because felled material would be removed from the site manually. Therefore, modeling hand pile and burning provides a maximum estimate of impacts in hand treated urban lots.
- To simplify the CWE analysis modeling, all urban lot hand treatments were assumed to occur in year 2, and all CTL urban lot treatments were assumed to occur in year 3. In reality, urban lot hand treatment stands would be treated as soon as possible, but would

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 year 3.

- The recommended ERA coefficients for wildfire provide a range of values for varying fire intensities (i.e. low, moderate, and high). For the South Shore CWE analysis, the highest value in the range associated with each fire intensity was applied to model the worst case scenario. The high end of the recommended ranges for ERA coefficients which were used for this project are displayed in Table 3-44 above. The wildfires included in the CWE analysis and the affected watersheds are displayed below in Table 3-45.

Table 3-45 Wildfires and Affected Watersheds in this CWE Analysis

Wildfire	Year	Affected Watersheds
Angora	2007	Angora Creek, Camp Richardson Frontal, Lower Upper Truckee River, Osgood Swamp, Taylor Creek
Cathedral	2006	Taylor Creek
Showers	2002	Benwood Meadow, Big Meadow Creek
Gondola	2002	Bijou Frontage
Pioneer 2	2002	Cold Creek
Kiva	2002	Tallac Creek, Taylor Creek
Cascade	1994	Taylor Creek

- The LTBMU typically waits approximately two years after piles are created before burning them 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 latest 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 hand piles are burned.
- Prescribed underburning may be substituted for hand piling and burning within hand treatment units in SEZs and aspen stands. Because this would be limited to only a few of the SEZ hand treatment units, and effects of underburning 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 analysis (USDA FS 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 3-46, next page.

Table 3-46. 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 3-50 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 foreseeable future channel and SEZ restoration activities were considered qualitatively for their effects, but could not be included in the ERA analysis. The ERA methodology is based on impervious coverage, with no method to credit channel and SEZ restoration activities with a reduction in ERA. There is also no coefficient for failing channel banks or incised channels, so existing degradation of stream channels and SEZs is not included in the ERA methodology unless there is existing impervious coverage.
- Recent and future Tahoe Fire and Fuels Team (TFFT) treatments were also added to the CWE analysis for the South Shore project. This includes treatments from 2008-2010 for the Lake Valley Fire Protection District, CA State Parks, California Tahoe Conservancy, and the City of South Lake Tahoe.
- A long-term restoration project for the Angora Fire burn area has been planned, with the decision document signed in fall 2010. The proposed treatments for the Angora Long-term Restoration Project (ALTR) were included in the South Shore CWE analysis. The impacts of the ALTR project on ERA and Risk Ratios for the 5 watersheds affected by the fire (Angora Creek, Camp Richardson Frontal, Lower Upper Truckee River, Osgood Swamp, and Taylor Creek) in the first year of ALTR treatments were analyzed separately from the first year of proposed South Shore treatments for each action alternative to demonstrate the relative difference in the magnitude of treatments proposed by each project

CWE Results

Appendix A lists the past, present and reasonably foreseeable future projects within the South Shore analysis area watersheds, including all projects considered for the CWE model. The past, present and reasonable foreseeable future vegetation management projects included in the CWE analysis are shown in Map 6. The South Shore project analysis area intersects 21 HUC7 watersheds (Map 10). 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. Because only 18 of these HUC7 watersheds have proposed South Shore activities within them, those 18 watersheds were included in the CWE analysis.

Table 3-47 presents a summary of the CWE analysis results using the ERA methodology for the five years after initiation of proposed South Shore Project treatments, and the final year of the model simulation, 10 years after project initiation. This table also displays the maximum change in risk ratio (RR) associated with proposed treatments in each watershed for both action alternatives. (See the Water and Riparian Resources 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 3-47, existing roads, trails and impervious coverage from development account for most of the ERA in the South Shore watersheds. Specifically, four of the 18 watersheds analyzed exhibited an ERA over the TOC, (see highlights in Table 3-47), 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 Lake Tahoe, where the primary land use is urban development. The 4th watershed that is over TOC before proposed treatments are applied is the Angora Creek watershed, due to the effects of the Angora wildfire. These are the only watersheds in the South Shore analysis area that begin over TOC or that go over TOC during the analysis period, and all are > 100% RR due to the existing conditions in these watersheds.

There is a need to reduce hazardous fuel loads and wildfire risk in these four watersheds that are over TOC, and the purpose and need for the South Shore Project would not be met without treatments in these watersheds. The scheduling and types of treatment activities in these watersheds were designed to reduce impacts for Alternative 2 and to minimize impacts with Alternative 3. Additional changes to either the timing or type of treatments would not affect the number of watersheds that are over TOC.

The South Shore treatments in either Alternative 2 or 3 do not cause an increase in ERA that would exceed TOC for any of the other project area watersheds. The remaining 14 watersheds in the South Shore analysis area exhibit ERAs that are well below their TOC both during and at the conclusion of the project (Table 3-47).

Several triggers were agreed upon by the LTBMU and Lahontan Water Board in order to meet the requirements of the Lahontan Timber Waiver and determine whether more detailed analysis, including site specific field evaluations, is needed to evaluate the potential impacts of the proposed treatments and identify resource protection measures needed to reduce those impacts and meet water quality requirements. These triggers were based on outcomes from the CWE analysis for a given watershed. The primary triggers for additional monitoring or analysis requirements were: 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. However, based on the revised 2009 Timber Waiver language and comments received from the public, the Lahontan Water Board and TRPA staff, monitoring sites will be selected based on the risk for impacts, rather than on the CWE results, as described in Chapter 4.

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 3-47). These watersheds are Tallac Creek, which experienced a 26.2% maximum increase in RR, and Taylor Creek which experienced a 27.1% maximum increase. While this is a substantial increase in RR over a short period of time, these watersheds still remain well below their TOC during the analysis period.

For Alternative 3, treatments and acreages were modified in several areas of the project. The changes in the Tallac and Taylor Creek watersheds resulted in a reduction in the maximum percent increase in RR from treatments in these watersheds to 18.4% and 17.5%, respectively.

Only one watershed that is currently over TOC, Camp Richardson Frontal, would experience an increase in RR of 5% or more (Table 3-47). The treatments in Alternative 2 would result in a maximum increase in RR of 10.1% during the analysis period. For Alternative 3, a 7.4% maximum increase would occur in the first year of implementation. This watershed was substantially impacted 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 to reduce levels of hazardous fuels in Alternative 3.

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. The remaining 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.

The action alternatives would result in some increased disturbance in the affected watersheds. The application of resource protection measures and 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 application of the BMPs and resource protection measures described in Chapter 2 and implementation of the monitoring described in Chapter 4, the risk of adverse cumulative effects to water resources within the project area is low and beneficial uses in 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 3-47. CWE Results Summary for Alternative 2 and Alternative 3 (watersheds over 100% RR are highlighted)

HUC 7 Name	Alternative 2 Existing Conditions					Alternative 2 Risk Ratio Associated with South Shore Treatments							
	Total Acres	TOC %	TOC Acres (allowable IC)	2010 RR without wildfires	2010 RR with wildfires	2010 RR with ALTR	2010 RR with all and Alt 2	2011 RR with Alt 2	2012 RR with Alt 2	2013 RR with Alt 2	2014 RR with Alt 2	2020 RR with Alt 2	Max RR increase
Angora Creek	3693.6	14.44%	533.3	47.94%	207.87%	233.50%	238.31%	226.87%	216.15%	205.19%	193.41%	123.97%	4.81%
Benwood Meadow	3682.8	7.77%	286	6.55%	41.39%	41.39%	41.60%	39.11%	36.48%	33.82%	30.94%	13.13%	0.21%
Big Meadow Creek	3271.0	5.91%	193.4	15.51%	22.87%	22.87%	29.77%	28.99%	28.34%	32.37%	31.34%	24.45%	9.50%
Bijou Frontage	3763.3	12.67%	476.9	180.25%	180.28%	180.28%	180.28%	180.95%	181.19%	181.56%	181.39%	180.40%	1.28%
Camp Richardson Frontal	2658.0	14.68%	390.1	106.96%	168.80%	175.90%	184.16%	186.72%	183.35%	181.94%	176.57%	144.98%	10.82%
Cascade Creek	3019.1	4.11%	124.1	21.18%	21.18%	21.18%	24.73%	24.45%	24.15%	23.87%	23.57%	21.94%	3.55%
Cold Creek	8172.9	5.89%	481.7	28.61%	28.63%	28.63%	28.72%	28.52%	29.65%	29.38%	29.11%	27.65%	1.02%
Echo Creek	3459.7	4.66%	161.2	27.42%	27.42%	27.42%	28.62%	30.27%	30.80%	38.16%	37.61%	34.26%	10.74%
Glen Alpine Creek	6935.7	3.19%	221	16.64%	16.64%	16.64%	16.64%	16.64%	17.26%	17.23%	17.61%	17.30%	0.97%
Grass Lake	4032.6	6.43%	259.2	21.27%	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%	567.6	9.16%	9.16%	9.16%	11.65%	12.25%	21.74%	23.76%	23.81%	18.37%	14.65%
Lower Trout Creek	3538.4	16.38%	579.6	72.34%	72.34%	72.34%	78.65%	79.64%	83.56%	89.43%	88.22%	81.06%	17.09%
Lower Upper Truckee River	4292.4	14.80%	635.1	130.70%	143.90%	145.61%	149.62%	149.57%	148.15%	147.71%	146.03%	137.58%	4.01%
Middle Upper Truckee River	4033.6	11.36%	458.2	53.94%	53.94%	53.94%	59.18%	60.46%	62.86%	65.83%	65.21%	61.19%	11.89%
Osgood Swamp	3145.6	17.00%	534.7	63.49%	72.63%	73.31%	77.01%	76.90%	76.08%	80.35%	78.83%	70.29%	7.05%
Saxon Creek	5397.2	9.17%	495	25.78%	25.78%	25.78%	27.83%	27.66%	37.05%	37.38%	37.22%	31.99%	11.60%
Tallac Creek	2790.1	8.84%	246.7	30.97%	32.26%	32.26%	36.74%	47.77%	56.34%	58.43%	56.46%	44.99%	26.18%
Taylor Creek	4985.1	8.28%	412.7	56.49%	62.75%	62.80%	62.93%	77.71%	89.86%	88.04%	83.96%	66.57%	27.06%

Table 3-47. CWE Results Summary for Alternative 2 and Alternative 3 (continued)

HUC 7 Name	Alternative 3 Existing Conditions					Alternative 3 Risk Ratio Associated with South Shore Treatments							
	Total Acres	TOC %	TOC Acres (allowable IC)	2010 RR without wildfires	2010 RR with wildfires	2010 RR with ALTR	2010 RR with all and Alt 3	2011 RR with Alt 3	2012 RR with Alt 3	2013 RR with Alt 3	2014 RR with Alt 3	2020 RR with Alt 3	Max RR increase
Angora Creek	3693.6	14.44%	533.3	47.94%	207.87%	233.50%	235.28%	223.92%	213.52%	202.47%	190.88%	122.55%	1.78%
Benwood Meadow	3682.8	7.77%	286	6.55%	41.39%	41.39%	41.39%	38.84%	36.09%	33.39%	30.51%	12.85%	0.00%
Big Meadow Creek	3271.0	5.91%	193.4	15.51%	22.87%	22.87%	28.73%	27.96%	27.66%	28.33%	27.51%	22.06%	5.86%
Bijou Frontage	3763.3	12.67%	476.9	180.25%	180.28%	180.28%	180.28%	180.95%	181.19%	181.56%	181.39%	180.40%	1.28%
Camp Richardson Frontal	2658.0	14.68%	390.1	106.96%	168.80%	175.90%	183.28%	182.28%	178.51%	180.18%	174.85%	144.48%	7.39%
Cascade Creek	3019.1	4.11%	124.1	21.18%	21.18%	21.18%	24.73%	24.45%	24.15%	23.87%	23.57%	21.94%	3.55%
Cold Creek	8172.9	5.89%	481.7	28.61%	28.63%	28.63%	28.72%	28.52%	29.69%	29.42%	29.15%	27.67%	1.06%
Echo Creek	3459.7	4.66%	161.2	27.42%	27.42%	27.42%	28.56%	30.27%	30.76%	31.57%	31.34%	30.41%	4.27%
Glen Alpine Creek	6935.7	3.19%	221	16.64%	16.64%	16.64%	16.64%	16.64%	17.26%	17.23%	17.61%	17.30%	0.97%
Grass Lake	4032.6	6.43%	259.2	21.27%	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%	567.6	9.16%	9.16%	9.16%	12.45%	12.44%	16.98%	19.03%	19.60%	15.55%	10.44%
Lower Trout Creek	3538.4	16.38%	579.6	72.34%	72.34%	72.34%	78.50%	79.64%	80.80%	83.56%	82.65%	77.29%	11.22%
Lower Upper Truckee River	4292.4	14.80%	635.1	130.70%	143.90%	145.61%	147.57%	148.33%	147.05%	146.39%	144.79%	136.80%	2.72%
Middle Upper Truckee River	4033.6	11.36%	458.2	53.94%	53.94%	53.94%	58.72%	59.91%	63.04%	63.49%	62.99%	59.80%	9.55%
Osgood Swamp	3145.6	17.00%	534.7	63.49%	72.63%	73.31%	74.11%	75.52%	74.78%	77.56%	76.19%	68.57%	4.25%
Saxon Creek	5397.2	9.17%	495	25.78%	25.78%	25.78%	27.82%	27.64%	35.29%	36.59%	36.25%	31.36%	10.82%
Tallac Creek	2790.1	8.84%	246.7	30.97%	32.26%	32.26%	37.76%	43.77%	49.90%	50.68%	49.34%	40.28%	18.42%
Taylor Creek	4985.1	8.28%	412.7	56.49%	62.75%	62.80%	62.80%	70.08%	79.71%	80.25%	76.32%	61.60%	17.45%

Analytical Conclusions

This section provides a brief summary of the conclusions of the effects analysis for water and riparian resources. It also provides linkages between the resource protection measures in Chapter 2 and the magnitude, scope, intensity, and significance of the environmental effects from project activities on water quality, riparian resources, and overall cumulative watershed effects.

For Alternative 1, previously planned restoration projects, erosion control projects, road maintenance activities and BMP retrofits would continue to improve watershed conditions, but would not result in any of the four watersheds currently above 100% risk ratio (RR) under existing conditions for cumulative effects to recover sufficiently to go below the threshold of concern (i.e., below 100% RR). In addition, continued increases in fuel accumulations would increase the risk for a high intensity wildfire, which increases the potential for erosion and sediment delivery and nutrient mobilization, and could adversely affect water quality and beneficial uses.

There are many similarities between the two action alternatives (i.e. Alternatives 2 and 3), such as the project resource protection measures detailed in Chapter 2. Therefore, these alternatives and their anticipated effects are discussed together here, with differences between the alternatives detailed at the end of this section. The potential for a large scale wildfire would be reduced with either action alternative as compared to the existing conditions (i.e. Alternative 1), due to the resulting reduction of hazardous fuels on the landscape. The reduced risk for a large scale wildfire in this area decreases the likelihood for water quality impacts from a post fire erosion event, and protects against wide spread vegetation and habitat loss at the watershed scale.

Stream channel conditions are not expected to be affected by the proposed project activities associated with Alternative 2 or 3 because of resource protection measures for temporary stream crossings (R-8, R-9, and R-10), stream buffers for mechanical equipment exclusion (WS-11, WS-13, WS-14, and WS-15), and the 5 ft “no take” buffer along stream banks (AR-2). In addition, implementation of either action alternative would involve replacing 3 permanent stream crossings that are currently acting as fish passage and/or sediment conveyance barriers and possibly as a sediment source with improved crossings.

Although impacts to water quality are not expected to result from project activities proposed with either action alternative, the greatest potential for water quality effects comes from the proposed whole-tree treatments, landings and skid trails in close proximity to surface water features, and temporary and permanent roads. In general, BMPs focus on controlling erosion and subsequent sediment delivery to streams and other water bodies in both action alternatives. BMPs are designed to control sediment of all size classes through a combination of minimizing soil disturbance, dispersing flows, and establishing buffers adjacent to waterbodies with high surface roughness; no distinction is made between coarse and fine sediment. Due to the greater potential for impacts associated with WT treatment techniques; whole-tree equipment will be prohibited from operating in SEZs (WS-16), and larger buffers have been prescribed in WT treatments units to provide added protection to water quality (WS-14). In addition, landings are not permitted within SEZs, and temporary roads for this project have been located outside of SEZs to the extent feasible. Specific measures are prescribed for landing and temporary road decommissioning so that water quality effects are avoided. Any sediment delivery resulting from project treatments would not be measurable above background levels.

Impacts to beneficial uses are not expected to result from project activities. The 2 beneficial uses (BU) for Lake Tahoe that have been identified as having the greatest potential for project effects are the non-contact water recreation BU and the cold freshwater habitat BU. The resource protection measures identified above for water quality protection will also avoid effects to the non-contact water recreation BU, in that sediment delivery to surface waters will be avoided, and will not be measurable above background levels. The cold freshwater habitat BU will be protected with the 5 ft stream bank no take exclusion and the CWD retention resource protection measures.

Finally, SEZs, floodplains and aspen stands have a potential for effects from the proposed Alternative 2 and 3 treatments related to pile burning and mechanical treatments in SEZs. Resource protection measures have been developed specifically for piling and burning in SEZs (WS-17 through WS-22), including a 50 ft no piling buffer for perennial and intermittent streams and water bodies, and a 10 ft buffer for ephemeral stream channels. These buffers are designed to reduce sediment and ash transport below a level of significance, and the 50 ft buffer for perennial and intermittent channels has been an adequate protection measure in the past for avoiding effects to water quality from this source. In addition, resource protection measures including spacing requirements and limiting the extent of piles in SEZs will prevent effects to SEZs, floodplains and aspen stands by protecting the riparian vegetation. Finally, an adaptive management approach is proposed based on the monitoring results and research findings (see Chapter 4 for more details). If ash or sediment transport is found during SEZ pile burn monitoring, the buffer width would be adjusted, or other responsive actions would take place to correct the issue for future pile burning.

Vegetation management treatments in SEZs, floodplains and aspen stands, which involve the removal of conifer species will improve the condition of the SEZs by improving riparian vegetation health and water availability. Therefore, for both action alternatives, SEZ treatment units were evaluated for possible mechanical CTL treatment using the SEZ Sensitivity Rating criteria (Appendix C) based on the Heavenly Valley Creek SEZ Demonstration Project (HSEZ) to evaluate and refine treatment types and reduce negative impacts. Units (or portions of units) that were found to be more sensitive than the HSEZ project site were not considered for mechanical treatment methods. These field evaluations of SEZ treatment units resulted in changes from CTL to hand treatment based on the observed sensitivity of some units, and reduce effects to SEZs from CTL mechanical treatment to less than significant.

Furthermore, under Alternative 2 no watershed that is not currently over the 100% RR threshold would go over that threshold due to the proposed treatments. Cumulative watershed effects are not expected to result from Alternative 2 treatment activities. Alternative 2 would generate some localized, short-term effects to water quality and riparian resources, but analysis results indicate that these effects to water quality, stream channel condition, and SEZs, floodplains and aspen stands would be mitigated to the extent feasible with project specific resource protection measures and BMPs, and are not expected to be significant.

For Alternative 3, several changes were made to project treatment type, temporary roads and landings to further reduce negative effects to water quality and riparian resources. Temporary road miles were reduced in Alternative 3 and landings in RCAs were reduced by 41%. As with Alternative 2, no watershed that is not currently over the 100% RR threshold would go over that threshold due to Alternative 3 activities. In addition, increases in RR associated with project treatments were reduced to the extent feasible in Alternative 3 for most of the watersheds over the TOC (Angora Creek, Camp Richardson Frontal, and Lower Upper Truckee River), and for several other watersheds included in the CWE analysis. Evaluation of all factors for water quality, riparian resources, and cumulative watershed effects shows that negative environmental effects have been reduced below significance for the preferred alternative, Alternative 3.

Aquatic Wildlife

Scope of the Analysis and Indicators of Effect

Species considered are based on the April 29, 2010 (verified on December 16, 2010) list of federally threatened, endangered, proposed, and candidate species for the Lake Tahoe Basin Management Unit (LTBMU) from the U.S. Department of Interior. Fish and Wildlife Service (USFWS 2010). 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.

Informal ESA consultation for Lahontan cutthroat trout (LCT) was concluded on June 23, 2009 (file no. 2009-I-0355). The US Fish and Wildlife Service concurs with the overall project design, monitoring and resource protection measures which have objectives of protecting LCT individuals and habitat. Any implementation strategy change or new biological information for LCT or other new listings for other species will potentially trigger the need to re-initiate consultation.

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*)

Lahontan cutthroat trout is the only species discussed that are being considered further in this section, is a listed threatened species, and therefore 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 Riparian Conservation Areas (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, and recommendations received have been incorporated into this FEIS. 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 12). 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.

The **Sierra Nevada (mountain) yellow-legged frog** *(Rana sierrae;* SNYLF) was discussed with USFWS to determine whether technical assistance should be requested for the candidate discussed. Both USFWS and LTBMU agreed that although SNYLF 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 SNYLF do not occur within the area of South Shore project activities or impacts, SNYLF 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 provides specific Forest-wide standards and guidelines for RCAs and CARs and addressed conservation needs for species of concern (threatened, endangered, candidate and sensitive). Resource protection measures to achieve RCOs are described in Chapter 2.

The following indicators are used as measures of project effects on aquatic habitat and species:

- Aquatic species population and distribution
- Stream shading and water temperature
- Coarse woody debris (CWD)
- 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/approx. 31 lbs.), utilizing primarily bottom-feeding chubs (*Siphatales bicolor pectinifer*) and native zooplankton as the 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. Lahontan cutthroat trout have been 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. Brown trout and brook trout, however, 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.

Existing Conditions – 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 3-48 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 (~9-24°C) 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 3-48. 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 17). 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).

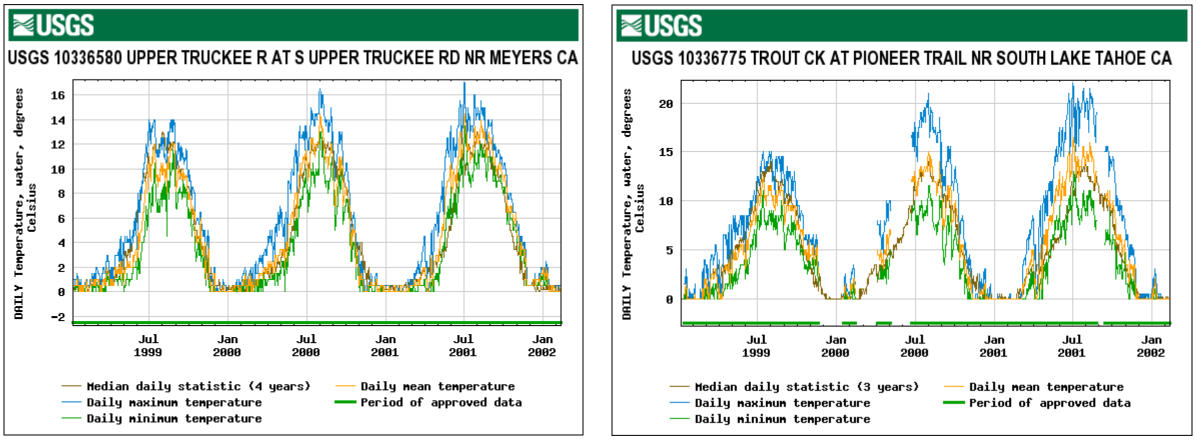

Figure 17. Average Daily Temperatures for Trout Creek and Upper Truckee River between 1999-2002

Existing Conditions – Coarse Woody Debris (CWD)

Coarse woody debris (CWD) is a natural component of unmanaged streams, and has a very complex role in hydrologic, chemical, and biological processes (Lehane et al 2002). CWD has been found to increase habitat diversity, through formation of pools and creation of resting places from swift currents. CWD also enhances the quality of food available to fish (Angermeier and Karr, 1984).

Present and future levels of CWD are influenced by living, dead, and dying trees within the riparian corridor. Trees closer to the stream than they are tall would directly influence the stream if they fall toward the stream channel. Table 3-53 summarizes CWD data collected in the field seasons of 2005 and 2006. Current CWD levels are at or above the range of natural variability found within the Sierra Nevada (Berg et al. 1998). The South Shore project would 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 CWD. 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 CWD 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 CWD per mile among any streams within the project area. There are several reasons for the lack of CWD in Taylor Creek: Coarse 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 CWD 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 resource protection measure for having a fisheries biologist onsite during implementation to assess shade and enhance coarse 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 3-49 represents a comparison of CWD 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 CWD can occur across a wide range of streams.

Table 3-49. 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		
Notes: *compared to Berg et al. 1998 “Function and dynamics of woody debris in stream reaches in the central Sierra Nevada”					

Existing Conditions – 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).

Existing Conditions – 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 have 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, 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 (naturally-occurring pesticide) 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 (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 may 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 would occur with introduced trout.

Lahontan cutthroat trout have been stocked into Fallen Leaf Lake as part of a USFWS pilot research project to examine their interactions with non-native lake trout. This is the only lake within the South Shore project area known to contain LCT (Map 12), although reproduction is currently 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 a wide range of habitats – from the Columbia River drainage in the north to central Nevada and California in temperatures ranging from 35-86°F (~2-30°C). 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 Snail

Great Basin rams-horn snail (*canadensis californiana)* 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 snails 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 3-50. Species Accounts by Stream within the South Shore project 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	

Notes: 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 "*" (asterisk).

Environmental Consequences – Aquatic Habitat

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.

Direct and Indirect

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 CWD is already at excessive levels, spanning streams and functioning as shade.

The amount of CWD 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 CWD within channels. An increase in coarse woody debris within the RCA and SEZ would raise the risk level of high intensity fire in the RCA; this would potentially result in undesired post-wildfire effects to aquatic habitat from loss of CWD, and an 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 CWD 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. Coarse 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 within aspen stands) would increase the vigor of meadow/riparian vegetation and conserve these landscapes that are important in maintaining highly productive aquatic habitats.

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.

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 RCA’s 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. Needed temporary road crossings would be located over ephemeral tributaries (in every instance possible), thereby reducing 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 – Preferred Alternative

As compared to Alternative 2, the overall acreage of hand thinning units within RCAs and SEZs increases under Alternative 3; this is due to changes in prescriptions from mechanical to hand treatment. Where mechanical treatments in SEZs have been changed to hand thinning, potential effects on CWD are less than what would be expected in Alternative 2. The amount of potential CWD 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 RCA's 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 the majority of landings out of RCAs, and reducing the number of landings overall. Almost all of the needed temporary road crossings would occur over ephemeral tributaries, and would not be likely to affect aquatic species.

Cumulative Effects

Appendix A includes 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

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.

Current Actions

The Angora Fire (in June 2007) 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 the 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 riparian/wetland restoration projects scheduled to occur in the reasonably foreseeable future (channel reconstruction, large wood placement, road/trail BMP improvements and meadow reclamation) would increase the rate of recovery within the Angora Fire area.

Reasonably Foreseeable Future Actions

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, CWD 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 would 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 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 effects to aquatic species and their habitats 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). Of 18 HUC7 watersheds analyzed, four exhibit values over the TOC before proposed South Shore project treatments are applied, and would 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.

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, CWD 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 – Preferred Alternative

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.

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 (i.e. water quality, channel stability, pools, CWD, 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 Environmental Consequences of the Project Alternatives

Lahontan Cutthroat Trout

Direct and Indirect

Alternative 1 – No Action

Under Alternative 1 riparian vegetation conditions would continue to have excessive fuel loadings. Fire behavior models predict an active fire that would consume most of the ground fuels and move 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 (e.g. 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. CWD, 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.

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. In order to decrease the level of predation on newly stocked fry, fish are now placed in Fallen Leaf Lake at strategic locations along the shore zone margins during the thermocline. Stocking during the thermocline is intended to allow spatial separation between juvenile LCT and spawning lake trout. 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. The US Fish and Wildlife Service operates an LCT hatchbox program in Glen Alpine Creek during the months of May and June. The hatchboxes are installed along the margins of Glen Alpine Creek falls where oxygenated water serves to support egg incubation and early life stage development (alevins, parr and fry). Fry are then released from the hatchboxes into Glen Alpine Creek below the falls. The incorporation of project resource protection measures for Aquatic Resources (Chapter 2, pg. 2-24) is further expected to conserve aquatic habitat features in Glen Alpine Creek, such as riparian vegetation and large wood debris. The overall aquatic habitat integrity (lake and stream) would be maintained both during and immediately after fuels treatment.

Alternative 3 – Preferred Alternative

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 US Fish and Wildlife Service operates an LCT hatchbox program in Glen Alpine Creek during the months of May and June. The hatchboxes are installed along the margins of Glen Alpine Creek falls where oxygenated water serves to support egg incubation and early life stage development (alevins, parr and fry). Fry are then released from the hatchboxes into Glen Alpine Creek below the falls. 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 for Lahontan Cutthroat Trout

Alternative 1 – No Action

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 would 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; therefore there would be no cumulative effect generated by Alternative 1.

Alternative 2 – Proposed Action

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 is planned to 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 Tahoe Basin

Recovery Implementation Team (TBRIT) expects to 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 (25.4cm/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, CWD 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 with 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 – Preferred Alternative

By decreasing the amount of combustible fuels within Upper Truckee River RCA's/SEZ's the potential for future effects on LCT resulting from wildfire (with Alternative 3) would decrease. Alternative 3 proposes less mechanical fuel treatment in RCA's/SEZ's and implements additional vegetation design criteria beneficial to aquatic habitats compared to Alternative 2.

The effects from the Angora Fire and Lahontan cutthroat trout habitat reclamation would remain the same as with Alternative 2. Stream and watershed restoration efforts are also expected to occur and improve aquatic habitat quality for LCT (i.e. channel stability, pools, CWD and benthic productivity) over the long-term (> 5 years), as discussed with 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 Snail

Direct and Indirect

Alternative 1 – No Action

Under Alternative 1 riparian vegetation conditions would continue to have excessive fuel loadings. The No Action Alternative would not reduce these fuel loads.

Fire models predict an active fire that would consume most of the ground fuels and movs 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 snail 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 snail. Therefore, any mortality or localized individual displacement from a potential wildfire would not change the overall range-wide population status of the species.

Alternative 2 – Proposed Action

Fish surveys conducted in the Upper Truckee River (Sunset Reach) did not detect Lahontan Lake tui chub nor Great Basin rams-horn snail 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 snail 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. Alternative 2 proposes 7 mechanical treatment units and 1 hand treatment unit adjacent to Fallen Leaf Lake. B ecause tui chub normally reside at depths greater than 5 feet in Fallen Leaf Lake it not expected that fuel reduction activities would have impacts to the species behavior or cause mortality to individuals.

Alternative 3 – Preferred Alternative

Alternative 3 proposes the same mechanical treatment units and hand thinning units as Alternative 2 within the Taylor/Tallac/Upper Truckee River marsh area (north of highway 89/ highway 50 intersection), objectives of reclaiming wet meadow habitats from encroaching conifers in a 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 snail 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. Alternative 3 proposes the same mechanical and hand treatment units would be implemented adjacent to Fallen Leaf Lake. Because tui chub normally reside at depths greater than ~1.5m/5 feet in Fallen Leaf Lake; it is not expected that Alternative 3 fuel reduction activities would have impacts to the species behavior or cause mortality to individuals.

Cumulative effects for Lahontan Lake tui chub and Great Basin rams-horn

Alternative 1 – No Action

Although past, present and future stream restoration would improve tui chub and Great Basin rams-horn habitat conditions, the presence of invasive non-native largemouth bass and Asian clam (*Corbicula*) would 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; therefore there would be no cumulative effect generated by Alternative 1.

Alternative 2 – Proposed Alternative

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 asian clam *(Corbicula)* 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 – Preferred Alternative

There are no measurable cumulative effects to Tui chub and Great Basin rams-horn snail 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 FS 1996, USDA FS 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 cannot 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 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 would **not affect** the Great Basin rams-horn snail for Alternatives 1, 2, and 3.
- The South Shore project would **not affect** the Delta smelt, Sierra Nevada yellow-legged frog, Yosemite toad, or the northern leopard frog for Alternatives 1, 2, and 3.

Table 3-51. Threatened, Endangered, and Sensitive Species for the LTBMU, and Effects 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				
Sierra Nevada 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 (H*elisoma newberryi newberryi*)	Forest Sensitive Species	Yes^	Yes	no effect
^ suspected to occur				

Analytical Conclusions

This section provides a brief summary of the conclusions for the analysis of effects to aquatic wildlife. Each section provides the results of resource protection measures in Chapter 2 (on the magnitude, scope, and intensity of the environmental effects from project activities) for Lahontan cutthroat trout and other aquatic species. Significance findings are also summarized within this section.

For Alternative 1, the amount of shade provided by conifers is not expected to change from current levels within the short-term of next 2-5 years along stream reaches. However, shade could slowly decrease over the long-term (> 5 years), as insect and disease outbreaks continue to affect canopy structure and foliage. The potential decrease in shade due to tree mortality may be offset by an increase in riparian shrub species shading as the amount of sunlight penetrating the forest floor increases. An exception is areas where CWD is already at excessive levels, spanning streams and functioning as shade. The amount of CWD within stream channels and along floodplains is expected to increase over the long-term (>5 years) from current levels. The increase in CWD within the RCA's and SEZ's would raise the risk level for high intensity fire in the RCA's, which could result in undesired post-wildfire effects to aquatic habitat from loss of shade and CWD; additionally, an increase of ash and fine sediment. No other changes in fine sediment would be expected.

Although stream shade within SEZ's may be reduced slightly over the short-term (< 5 years) under Alternative 2, 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. A measurable increase in stream temperatures is not expected as a result of mechanical and/or hand thinning activities in SEZ's. Thinning around meadow edges and in aspen stands would increase the vigor of meadow/riparian vegetation and conserve these landscapes – which are important in maintaining highly productive aquatic habitats. 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 RCA's) occur in Saxon Creek, Taylor Creek, Tallac Creek and Upper Truckee River under Alternative 2. Almost all of the needed temporary road crossings would occur over ephemeral tributaries, and reduce the risk for large of amounts of fine sediment delivery. The combination of Alternative 2 fuel reduction activities and ongoing watershed and stream restoration is anticipated to move streams, wetlands and meadows toward desired conditions within the South Shore project area. 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.

With 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 due to the retention of a wider range of size classes of trees creating a denser canopy cover 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. Because Alternative 3 reduces the mileage of temporary roads needed, it reduces the potential for sediment effects. Alternative 3 also reduces potential sedimentation by moving all but a few landings out of RCA's, and reducing the number of landings overall. Almost all of the needed temporary road crossings would occur over ephemeral tributaries, and would not be likely to affect aquatic species. The potential for sediment effects from mechanical treatments in RCA's would continue for Saxon Creek, Taylor Creek, and Tallac Creek due to the existing road density coupled with temporary roads, landings and stream crossings. 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. 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 to a slightly higher degree than Alternative 2. Negative environmental effects have been mitigated to below the level of significance for aquatic wildlife by Alternative 3.

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 and Indicators of Effect

None of the species discussed in this Terrestrial Wildlife section required consultation with the USFWS. Species considered are based on the April 29, 2010 (verified on June 13, 2010) list of federally threatened, endangered, proposed, and candidate species for the Lake Tahoe Basin Management Unit (LTBMU) from the U.S. Department of Interior. Fish and Wildlife Service (USFWS 2010). 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 2004a and USDA FS 2004b), and other applicable laws and regulations would be applied to this project. Key standards and guidelines from the Sierra Nevada Forest Plan Amendment (USDA FS 2004b) and land management practices from the Lake Tahoe Basin Management Unit, Land and Resource Management Plan (USDA FS LTBMU 1988) for terrestrial wildlife species and habitats are summarized in the Terrestrial Wildlife Biological Evaluation/ Biological Assessment (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 (CDFG, CA Interagency Task Group 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 from lowest to highest: 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 surveys for willow flycatcher, wetland bird, and/or fish and invertebrate species 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 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.

Background

Wildlife surveys originally were completed for the South Shore project in 2008. As subsequent wildlife surveys were conducted for above-project level monitoring or for other projects within the analysis area since 2008, some new information has become available and incorporated into this analysis. Furthermore, as a decision for this project was delayed by approximately two years, a second round of wildlife surveys was initiated for this project in spring 2010.

The LTBMU developed a survey strategy for this project for northern goshawk and California spotted owl to conduct new surveys while utilizing existing survey information. Following Region 5 direction and practices, survey results from two-year protocol surveys conducted in 2007/08 or 2008/09 will not be resurveyed unless to address a specific issue in a future year (e.g. the location of a nest tree within a PAC in 2011). Other suitable habitats will be surveyed unless a two-year protocol survey completed within the last five years did not detect the species and the habitat is not located within 0.25 mile of a Protected Activity Center. There is some risk that individuals of a species may occupy habitats where they did not occur within the last five years or were not detected. That risk generally is considered to be low as large scale changes in habitats (e.g. large scale wildland fires) have not occurred in the analysis area since the first round of surveys were completed (summer 2008) and because of the frequency, density, and relatively long history (20+ years) of relevant surveys in the analysis area. The 0.25 mile buffer around PACs was excluded from this five-year, non-detection approach because there is an increased risk that a goshawk or spotted owl may nest outside of, but in close proximity to, a PAC. In summary, a total of approximately 7,688 acres and 8,091 acres will be surveyed for the South Shore project in 2010 (and a similar amount in 2011) for goshawk and spotted owl, respectively. This survey strategy will be completed in suitable habitats for each stand prior to implementation or a species-specific LOP will apply as directed by the amended Forest Plan.

Existing Conditions – Wildlife Habitat

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 (~1,899 m) to 8,159 feet (~2,487m) within the project area, and 5,322 feet (~1,622m) to 10,881 feet (~3,317 m) 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, California 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 stream 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 2000a). 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.

Environmental Consequences – Wildlife Habitat

In order to avoid repetitive text, the overall effects of the alternatives to wildlife and their habitats will be discussed first, followed by discussions specific to individual species – in the following section (*Existing Conditions and Environmental Consequences – Individual Wildlife Species*).

Direct and Indirect

Alternative 1 – No Action

Under the No Action alternative, Current conditions in the wildlife analysis area would continue, and the existing risk of wildland fire in the analysis area would continue.

With the No Action alternative, the existing risk of wildland fire in the analysis area would continue. The Angora Fire (2007) demonstrated the effects of a wildland fire within the analysis area under severe fire weather conditions. Modeling of fire behavior within the analysis area supports the presumption that another fire within the South Shore analysis area under severe fire weather conditions would similarly affect the landscape (34.4% high burn severity, 42.1% moderate severity, and 23.5% low severity). Fires like the Angora Fire spread faster and have more severe effects than fires that occur within Condition Class 1 stands. Under severe fire weather conditions, stand-replacing events would be expected to occur. Wildlife communities would likely be adversely affected, in general, if a wildland fire occurred in the wildlife analysis area; however, this analysis does not assume there would be a wildland fire.

Conversely, if no fire occurs, it is reasonable to expect the forest would continue to develop late seral forest structure and be at risk of stochastic events such as insects and disease outbreak causing an increase in snags. These conditions would favor wildlife species associated with late seral structure. This scenario would require greater than 20 years to detect a measurable species assemblage change.

Alternative 2 – Proposed Action

Actions scheduled with 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 would 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.

The type of thinning method (i.e. mechanical or hand thinning) and thinning prescription for each stand determine post-implementation forest structure. Hand thinning treatments are limited in their ability to process the residual materials from live trees larger than 14 inches dbh or dead trees larger than 20 inches dbh due to the practical constraints associated with moving these large materials by hand. Live trees up to 18 inches dbh may be removed when removing trees up to 14 inches dbh is insufficient to change current expected fire behavior from a crown fire to a surface fire. Hand thinning treatments are generally constrained to removing more trees from the understory and mid-story than mechanical operations (which can remove more trees from the overstory) to achieve equivalent changes in stand condition (e.g. canopy cover or basal area).

Final stand structure does not differ by type of mechanical 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. Thinning operations would differ between uplands and stream environment zones (SEZs) in the types of follow-up treatments implemented. Upland mechanical treatments are similar to those in SEZs with the exception that chipping, masticating, and landing pile burning would occur in upland treatment units. Residual processed materials impact soil temperature, humidity, erosion potential and herbaceous and shrub recovery rates, which could 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.

Slash created by thinning treatments and existing coarse woody debris are stacked in piles with the intent of burning the piles when conditions prescribed within an approved burn plan are met, usually two to three years after treatment. Piles are generally distributed throughout a treatment unit. Piles are most often created by hand crews but may be constructed in CTL units by using a grappler attachment to a forwarder (Grapple pile). During pile burning fire is not confined to the pile. Fire is allowed to move through the unit to consume surface fuels that have not been piled. Pile burning is normally conducted as opposed to underburning as an initial fuels treatment due to the high accumulations of fuels generated by thinning. Underburning, also termed broadcast burning, refers to burning residual fuels in place when conditions in an approved burn plan are met. Landing pile burning is burning of the woody material that remains on landings when conditions in an approved burn plan are met. Material is typically machine piled.

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.

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.

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.

With 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.

Brushing would occur on a small scale, in limited portions of the project area. The effect of brushing on wildlife, given project resource protection measures 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 2000b). 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 would 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 would contribute to the resilience of this forest type to wildland fires and likely reduce overall wildland fire behavior. Conifer thinning from aspen stands would affect 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 increased habitat fragmentation and an increase of edge habitat; 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; therefore 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).

The need for 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 would be needed to implement the proposed action; these would be dispersed throughout the mechanical treatment units. The general effect of landings on wildlife would be an increase in the amount of forest edge habitat and an increase in 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.

Crossing and Culvert Replacement

Replacing these three crossings would introduce disturbance-type effects to forest dwelling species. Effects would likely include short term displacement of individuals (e.g. equipment flushing an individual) and changes in patterns of habitat use (e.g. avoidance of areas with ongoing project activities) during implementation. Effects would be reduced by implementing in the fall, after the nesting/denning season is completed. Long term benefits would occur as aquatic and riparian habiats respond to improved ecosystem processes (e.g. improved flow and habitat connectivity).

Alternative 3 – Preferred Alternative

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 with the elimination of acres 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 with 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 558 fewer acres, resulting in a lessening of 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.

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 42 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 42 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 10 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 Effects

Appendix A lists 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 1995 (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 (TRPA 2009).

Past vegetation projects within the wildlife analysis area treated approximately 11,282 acres (~46 km²). 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/[~46 km²] for the proposed action), and a similar time frame (15 years). Approximately 90 acres (less than 0.4 km²) of bark beetle-killed and generally dense, even aged, early to mid-seral lodgepole pine (*Pinus contorta*) stands recently were hand thinned in the High Meadows area, with effects to sensitive wildlife as for other thinning projects described below.

Past restoration projects within the wildlife analysis area have restored approximately 5.9 miles (~9.5 km) of streams and 210.5 acres (~0.9 km²) of SEZ, floodplain, riparian, aspen, 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, aspen, and meadow habitats provide more resources per acre (e.g. food, water, and cover) than uplands. See Appendix A for a summary of restoration projects that have been completed in the wildlife analysis area since 1995.

Past engineering projects within the wildlife analysis area are listed on the EIP web page (shown above), and summarized in Appendix A; which 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 and 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, planting new trees within the Angora Fire (2007) area, and 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 shorezone – where 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. 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 disturbance (e.g. 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 presumably 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. Tree planting is expected to cause short term disturbance, slightly above background disturbance levels, and benefit wildlife species and their habitats in the long term as planted trees mature and grow. Pile burning within the wildlife analysis 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 Lahontan Cutthroat Trout and Mountain Yellow-legged Frog Habitat Restoration in Desolation Wilderness, Big Meadow Creek Watershed Fire Regime Restoration, High Meadows Channel Restoration, Blackwood Creek Restoration, Angora Fire Restoration, and Aspen Community Restoration. The Lahontan cutthroat trout and mountain yellow-legged frog habitat restoration projects directly benefit aquatic species and/or their habitats within the wildlife analysis area and are described (with effects) in the BE/BA for aquatic wildlife species. Project activities at Big Meadow are focused on the removal of encroaching conifers from the meadow and adjacent aspen stands, thinning adjacent conifer stands, and reintroducing fire to the ecosystem. The Big Meadow project is expected to cause moderate benefits to meadow, aspen, and forest-edge associated plant and wildlife species in the long term following short term disturbance. High Meadows Channel Restoration will reconnect streams with their natural channels, decommission irrigation ditches, and remove encroaching conifers. Hydrologic connectivity and function will be restored at High Meadows providing moderate, long term benefits to meadow, aspen, and riparian habitats and the species that utilize them. Blackwood Creek Restoration is restoring sinuosity and elevating local water tables within the natural channel and floodplain, restoring aspen and cottonwood groves, and restoring coarse woody debris and stream cover in two stream reaches. Wildlife in the project area may experience slight, short term disturbance during project activities and for a short time afterward as trees and other riparian vegetation respond to the restoration, then experience moderate, long term benefits from improved ecological processes and productivity. 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.

Current engineering projects within the wildlife analysis area are listed on the EIP web page (TRPA 2009), and summarized in Appendix A; including: 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 High Meadows Access and Travel Management project being implemented on roads and trails within montane shrub, meadow, riparian, and mixed conifer forest habitats suitable for some sensitive wildlife species may cause short term disturbance to individual wildlife, though disturbance is not expected during the nesting season in nesting areas. The quality and quantity of habitats suitable for sensitive species located adjacent to affected road and trail segments should be improved over the long term as steep slopes are stabilized, vegetation preserved, and water quality improved. 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/~61 m) 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, is summarized 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 Taylor-Tallac and Upper Truckee River (Sunset Reach) Restoration projects differ from previous restoration projects in that they would restore large tracts of wetland systems directly adjacent or connected to Lake Tahoe. These projects would likely affect wildlife as described for other restoration projects, with additional benefits to species that utilize shore zones. The Upper Truckee River Restoration projects are expected to restore several miles of incised stream channel and adjacent riparian and meadow habitats, improving connectivity with local water tables, the quality and quantity of riparian herbaceous and shrub vegetation, and benefiting sensitive wildlife as described for past restoration actions. The Upper Truckee River reaches being restored are located within the urban interface and are part of the largest riparian/meadow system in the South Lake Tahoe area. Future restoration projects will continue to be focused on streams and other systems that have a substantial influence on water quality and clarity. 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 yet determined as of August 2011), 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 the past. 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 resource protection measures. 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 – Preferred Alternative

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.

Existing Conditions and Environmental Consequences - Individual Wildlife Species

The following section discloses the existing conditions 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 LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a).

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 (~433 km), (Zielinski et al 1995; Zielinski et al 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, coarse 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; Krohn et al 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).

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, LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a).

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 (~30351 km²) 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 (~23-31 km) northwest of the LTBMU (approximately 33-38 miles (~53-61 km) from the wildlife analysis area) near Truckee, California. Detections of this individual continued into March 2008 and have recurred in the same area (genetically confirmed to be the same animal) during winter and spring 2011. Agency biologists and researchers used genetic samples (i.e. hair and scat) to determine that the wolverine is most closely related to, and most likely came from, a population on the western edge of the Rocky Mountains, possibly from the Sawtooth Mountain Range in Idaho, rather than either the historic California population (compared to samples taken from museum specimens) or contemporary northern Cascades (Washington) population (Moriarty et al 2009). 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 denning 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 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 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 (TRPA 1987), 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 3-70.

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 LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a). The USFWS was petitioned by the Center for Biological Diversity to list Sierra Nevada red fox as threatened or endangered under the Endangered Species Act on April 27, 2011. The USFWS has 90 days to decide whether the petition presents enough information to warrant possible federal protection for the fox.

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). Genetic analysis indicates that a remnant population of the high-elevation native Sierra Nevada red fox persists in the high elevations of primarily the western half of Lassen Volcanic National Park and its surrounding area (Perrine 2005, Perrine et al. 2007). Outside of this area, recent surveys in the forests of the southern Cascade Range and throughout the Sierra Nevada have not detected Sierra Nevada red fox, as they may be extirpated or in extremely low densities in the areas surveyed (Zielinski et al. 2005), with the exception of three foxes detected near Sonora Pass along the border of Tuolumne and Mono Counties in August and September 2010. Other low-elevation red fox populations in California were thought to be of exotic origin (Perrine et al. 2007) until a recent genetic analysis (Sacks et al. 2010) identified a native subspecies in the Sacramento Valley (*V. v. patwin*) surrounded by multiple nonnative populations. Perrine et al. (2007 and 2010) support the use of a 3,500 feet elevation boundary that successfully seperates high-elevation from lowland populations for management purposes. The elevation boundary between the two populations is somewhat arbitrary and likely varies by latitude (Perrine 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/~479 m) 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 August 2010, biologists on the Humboldt-Toiyabe National Forest detected a red fox at an automatic camera station near Sonora Pass along the border of Tuolumne and Mono Counties (approximately 50 miles south of the Lake Tahoe Basin). Preliminary genetic analyses conducted at UC Davis indicate that the fox was a Sierra Nevada red fox (Perrine et al. 2010). 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). %he California Wildlife Habitats Relationships (CWHR) computer program (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 3-71 below.

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).

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. Only one marten den has been identified in the Lake Tahoe Basin, this could be due to the amount of effort needed to locate den sites (generally requires more costly and labor-intensive radio telemetry or tracking surveys). The single known den is on the west shore within Sugar Pine State Park. It was discovered opportunistically during a northern goshawk survey in 2009. 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 3-72.

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 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). 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 throughout the Lake Tahoe Basin. Site visits to determine the suitability of these sites were completed during early summer 2008 and acoustic surveys were conducted in 2008 and 2009. Townsend's big-eared bats are known to occur at four locations within the Lake Tahoe Basin: Blackwood Canyon and near McKinney Creek on the western shore, Skunk Harbor on the eastern shore, and Cookhouse Meadow on the southern shore (and within the analysis area). This species is known to roost at the McKinney Creek and Skunk Harbor locations.

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.

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 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. Both the adit and the pit of the Mountain Top mine were assessed for bat habitat in 2008. At that time it was thought that there may be a short tunnel connecting the two structures that could be suitable cave surrogate habitat. Acoustic surveys were conducted in 2009. Only a few bats were detected, but surveyors were certain that bats were seen/heard emerging from the pit and the adit. Townsend's were not detected. A visit to the Mountain Top mine during the summer of 2010 showed that the mine had caved in since it was originally surveyed and is no longer suitable as cave surrogate habitat. It is possible that the bats that were detected there were roosting in rock crevices. The remains of the mine were demolished in the fall of 2010.

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. The suitability of the bat habitat at Meiss cabin is unknown. No other potential Townsend's big-eared bat roost sites are known or identified within the wildlife analysis area.

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, LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a). 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 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 3-52.

Table 3-52. Existing acres of high and moderate capability bald eagle habitat within the project wildlife analysis area

Habitat Capability	Habitat Capability	Habitat Capability	Habitat Capability
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 (both described below) conducted from 2006 through 2010. Approximately 16,744 acres were surveyed (total for mid-winter count and nest surveys) for bald eagles in the Lake Tahoe Basin (5,104 acres surveyed within the wildlife analysis area). Mid-winter count and nest surveys within the wildlife analysis area have been completed through January 2010. In addition, a long-term bald eagle count and nest survey history (20+ years) exists in the wildlife analysis area. The results of subsequent, project-specific, relevant concurrent and historic surveys are considered in this analysis.

The LTBMU hosts annual mid-winter bald eagle counts (28th annual count in 2011) 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 11 years are presented below (Table 3-53).

Table 3-53. Results of bald eagle mid-winter counts in the Lake Tahoe Basin, 2000-2010

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total number of bald eagles detected	8	15	14	10	12	18	7	9	10	16	9	17

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 14 years (Table 3-54).

Table 3-54. Number of active bald eagle nests and juveniles fledged in the Lake Tahoe Basin 1999-2010

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of active nests	0	0	0	1	1	0	1	1	1	1	1	1
Number of juveniles fledged	0	0	0	2	0	0	1	2	2	2	0	1

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, LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a).

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 resource protection measures 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 F Forest Service, LTBMU 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 3-55.

Table 3-55. 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 (a2004b). 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).

The original round of surveys for goshawks was 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 (see page 23 for details on current surveys). 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. Due to the NEPA process being drawn out beyond the two year deadline outlined in the Region 5 protocol, surveys for this project were repeated in 2010 and will be completed in 2011. 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 3-56). 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 32 years (1977-2008) 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 2004a). 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 2004b). 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 3-56 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 3-56. 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

Protected Activity Center	Territory	PAC Acres	Habitat Capability	Nesting Habitat	Perching Habitat	Foraging Habitat
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 & Moderate	2,163	2,951	3,032

In summary, Table 3-57, beginning on the next page, 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 (2008-2010); 5) relative occupancy (frequently, moderately, infrequently occupied) as an indicator of habitat quality based on the process used by (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 2004b, p.60) is presented in the table to highlight PACs with recent activity.

Table 3-57. 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 2008-2010	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.	No	Frequent	Yes	Yes
Spring Creek	Spring Creek	Original nest in 1999 (reused 2000, 2001), other nests in 2003 (reused 2005 and 2009), 2004, and 2010; fledged 2 in 2003, 1 in 2004, 2 in 2009, and 2 in 2010; detections in 1999-2006,2009, and 2010.	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 1991, confirmed nest in 2003; no known fledging; detections in 1997, 2002-2005, and 2007-2010.	No	Infrequent	Yes	Yes
Seneca Pond	Angora 1	No known nests; no known fledging; detections in 1993, 2008-2010. This information is for the re-mapped PAC.	Yes	Moderate	Yes	Yes
Big Meadow	Big Meadow	Original nest in 2003 (reused in 2004), alternate nest in 2003, other nests in 2007 and 2009; fledged 3 in 2004, 2 in 2005 (no nest found), and 1 in 2007; detections in 1990, 1992, 1998, 2000-2005, and 2007-2010.	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 1998, 1999, 2003, 2007, and 2009.	Yes	Frequent	No	No

Protected Activity Center	Territory	Nesting, Fledging, and Occupancy Detected in PAC	Detection in PAC 2008-2010	Territory Occupancy	Treated in Alternative 2	Treated in Alternative 3
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, reused in 2006), and 2010; fledged 2 in 1998, 2001, 2005 and 2010; detections in 1991, 1994, 1997, 2001-2006, 2009 and 2010.	Yes	Frequent	Yes	No
Lower Saxon Creek	Saxon Creek	Original nest in 1992, different nests in 1993; no known fledging; detections in 1992-1993, 2003, 2005, and 2009.	No	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, 2001-2005, 2009 and 2010.	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	Moderate	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, 1995, 2002, 2003, 2006, 2007, 2009, and 2010.	Yes	Moderate	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.	No	Moderate	No	No
High Meadows	High Meadows	Original nest in 2004, other nest in 2009 and 2010; 1 fledged in 2004, 3 fledged in 2009, 2 fledged in 2010; detections in 2003-2005, and 2007-2010. Large tree die-off prompted re-mapping of PAC in 2007.	Yes	Frequent	No	No
None*	Sawmill Pond	Original nest in 2010: nest failed	N/A	N/A	Yes	Yes

* There is not currently a PAC associated with this territory because it is a new territory that was discovered in 2010. If the territory continues to be occupied in 2011 and 2012 a PAC will be designated.

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 LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a).

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 coarse 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 coarse 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 coarse 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 resource protection measures 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 3-58.

Table 3-58. 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 2004a). 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.

The original round of surveys for spotted owls was 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 1991, revised 1993) in 2006 and 2007 (see page 23 for details on current surveys). 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. Due to the NEPA process being drawn out beyond the two year deadline outlined in the Region 5 protocol, surveys for this project were repeated in 2010 and will be completed in 2011. In addition, a long-term spotted owl survey history (20+ years) exists in the wildlife analysis area. The results of subsequent, 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 29 years (1981-2009) 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 2004b). 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 3-59 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 3-59. 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 2004a). 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 3-60 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 3-60. 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 3-65 (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 (2007-2009); 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 2004a, p.60) is presented in the table to highlight PACs with recent activity.

Table 3-61. 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 2008-2010	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.	No	5	Yes	Yes	Yes	Yes
Tahoe Mountain	Tahoe Mountain	No known nest; no known fledglings; detections in 1993, 2000, and 2007.	No[b]	2[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.	No	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 2004 and 2007), other nests in 2003 and 2009; likely fledged 1 in 2003, 2 in 2004 and 2007, and 1 in 2009; detections 1991-92, 1996-05, and 2007-2010.	Yes	5	No	Yes	No	Yes
Hellhole	Trout Creek	No known nest; no known fledglings; detections in 1998-2000, 2002, and 2009.	Yes	2	Yes	Yes	Yes	Yes
Cold Creek	Cold Creek	Original nest in 2002 (reused in 2003, 2004, 2006, 2009, and 2010); fledged one in 2002 and 2010, fledged two in 2003 and 2004, fledged three in 2006; detections in 1999-2005, and 2007-2010.	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).

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 LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a).

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 F Forest Service 2004b). "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 2004b). 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 2004a). Breeding in California occurs from 2,500-8,000 feet (750-2,440 meters) elevation, from Green 1995 i(n USDA FS 2004a).

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 2004b, Sears 2006). Nesting and roosting occur in adjacent conifer forests, generally in areas where canopy cover averages greater than 40 percent (USDA FS 2004a). 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 2004a). 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 2004a).

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 2004a). 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 3-62.

Table 3-62. 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

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, LTBMU 1988), as amended by the Sierra Nevada Forest Plan Amendment (USDA FS 2004a).

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 stream 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 3-63.

Table 3-63. Existing acres of high and moderate capability willow flycatcher habitat within the project wildlife analysis area

<table>
<tr><th>Habitat Capability</th><th>Nesting Habitat</th><th>Perching Habitat</th><th>Foraging Habitat</th></tr>
<tr><td>High</td><td rowspan="2">2,727</td><td>2,727</td><td>2,727</td></tr>
<tr><td>Moderate</td><td>78</td><td>78</td></tr>
<tr><td>Total</td><td>2,727</td><td>2,805</td><td>2,805</td></tr>
</table>

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 2004a). 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 2004b). 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 2004b).

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).

The original round of surveys for this species was 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) (see page 23 for details on current surveys). 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 subsequent, 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 3-64 provides a summary of information for historically and recently occupied willow flycatcher habitats within the South Shore wildlife analysis area: 1) survey area (includes all known occupied habitats in wildlife analysis area); 2) detection (territories, adults, nests, and fledglings) and survey history; 3) whether detections occurred in the previous three breeding seasons (2007-2009); 4) contribution to productivity over the period surveyed (adapted from the method used for spotted owl); and 5) whether a vegetation treatment is proposed within the willow flycatcher habitat under Alternatives 2 or 3.

Table 3-64. 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 2007-2009	Contribution to productivity[a]	Treated in	
				Alt. 2	Alt. 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 2008: 1 territory; 2 adults; 1 nest; 1 fledged 2009: 1 territory, 2 adults; 1 nest; 2 fledged 2010: 3 territory, 3 adults; 1 nest; 3 fledged	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 2008: 2 territories; 3 adults; 2 nests; 7 fledged 2009: 2 territories, 3 adults; 3 nests; 5 fledged 2010: 2 territories, 4 adults; 1 nest; 4 fledged	Yes	2	No	No
Mattole Road	2010: incidental detection of pair with nest; outcome unknown	Yes	5	Yes	Yes
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 2008-2010: not surveyed	No	1	Yes	Yes

Survey Area	Willow flycatcher nesting, fledging, and occupancy detected in survey area	Detection in Survey area 2007-2009	Contribution to productivity[a]	Treated in	
				Alt. 2	Alt. 3
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 1999-2008: surveyed, but no detections 1999-2010: 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 2010: 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 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 2008: 1 territory; 1 adult; no nest 2009: 1 territory; 1 adult; no nest. 2010: 1 territory; 2 pair; 1 nest; 1 fledged	Yes	5	No	No
Cookhouse	2002: (original detection) 1 adult (non-territorial) 2003-2006: surveyed, but no detections 2007: not surveyed 2008: surveyed, but no detections 2009: surveyed, but no detections 2010: no surveyed	No	1	No	No

Survey Area	**Willow flycatcher nesting, fledging, and occupancy detected in survey area**	**Detection in Survey area 2007-2009**	**Contribution to productivity**[a]	**Treated in**	
				Alt. 2	**Alt. 3**
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 2002-08: surveyed, but no detections 2009: not surveyed 2010: surveyed, but no detections	No	5	No	No
Upper Truckee River (Airport)	2007: (original detection) 1 adult (non-territorial) 2008: surveyed, but no detections 2009: 1 territory; 1 adult; no nests (found incidentally) 2010: not surveyed	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 2003-08: surveyed, but no detections 2008-2010: not surveyed	No	1[b]	No	No
Edgewood Creek	2005: surveyed; unconfirmed detection of single bird 2006-2010: not surveyed	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 (2007-2009) 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 3-65.

Table 3-65. 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	
		Alt. 2	Alt. 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

Environmental Consequences - Individual Wildlife Species

The following section discloses the 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

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.

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

Direct and Indirect

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. 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. Direct and indirect effects would occur as disclosed in the General Effects by Alternative to Terrestrial Wildlife Species and Habitats, Alternative 1 section.

Alternative 2 – Proposed Action, and Alternative 3 – Preferred Alternative

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 3-66. 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 3-66. 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	0	19 / 59	+40	19 / 59	+40
	Moderate	0 / 0	0	785 / 745	-40	785 / 745	-40
	Total	0 / 0	0	804 / 804	0	804 / 804	0
Alternative 3	High	0 / 0	0	19 / 59	+40	19 / 59	+40
	Moderate	0 / 0	0	746 / 706	-40	746 / 706	-40
	Total	0 / 0	0	765 / 765	0	765 / 765	0
Wildlife analysis area	High	35		1,658		1,658	
	Moderate	59		21,120		21,685	
	Total	94		22,778		23,343	

Cumulative Effects for California Wolverine

Alternative 1 – No Action

No direct or indirect effects would occur under the No Action alternative; therefore no cumulative effects would occur.

Alternative 2 – Proposed Action

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 – Preferred Alternative

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).

Alternatives 1, 2, and 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 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

Direct and Indirect

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. 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.

Alternative 2 – Proposed Action

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 3-67. Total existing acres of these habitats within the wildlife analysis area are included in this table.

Table 3-67. 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
	Moderate	0	0	0	0	0	0
		0		0		0	
Wildlife Analysis Area	High	1,283		2,105		2,102	
	Moderate	0		0		2,105	
	Total	1,283		2,105		4,207	

Cumulative Effects for Sierra Nevada Red Fox – 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.

Alternatives 1, 2, and 3 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 Sierra Nevada Red Fox. Rationale: The proposed action would not occur within or create suitable habitats for this species.

American Marten

Direct and Indirect

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. 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.

Alternative 2 – Proposed Action, and Alternative 3 – Preferred Alternative

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 3-68. Total existing acres of these habitats within the wildlife analysis area are included in this table for comparison.

Project resource protection measures 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 3-68. 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	-118	1,003	+212	1,003	+212
		671		1,215		1,215	
	Moderate	7,461	-1,086	7,476	-967	7,476	-865
		6,375		6,509		6,611	
	Total	8,250	-1,204	8,479	-755	8,479	-653
		7,046		7,724		7,826	
Alternative 3	High	777	-133	980	+197	980	+197
		644		1,177		1,177	
	Moderate	6,923	-815	6,966	-719	6,966	-616
		6,108		6,247		6,350	
	Total	7,700	-948	7,946	-522	7,946	-419
		6,752		7,424		7,527	
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 resource protection measures 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.

Cumulative Effects for American Martin

Alternative 1 – No Action

No direct or indirect effects would occur; therefore no cumulative effects would occur.

Alternative 2 – Proposed Action

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 – Preferred Alternative

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.

Alternatives 1, 2, and 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 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

Direct and Indirect

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. 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 action alternative.

Alternative 2 – Proposed Action, and Alternative 3 – Preferred Alternative

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).

Cumulative Effects for Townsend's Big-eared bat

Alternative 1 – No Action

No direct or indirect effects would occur; therefore no cumulative effects would occur.

Alternative 2 – Proposed Action

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 – Preferred Alternative

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.

Alternatives 1, 2, and 3 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

Direct and Indirect

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 medial 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 3-69. 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 3-69. 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	+478	72	+96	72	+96
		612		168		168	
	Moderate	507	-387	135	-72	374	+84
		120		63		458	
	Total	641	+91	207	+24	446	+180
		732		231		626	
Alternative 3	High	134	+412	94	+96	94	+96
		546		190		190	
	Moderate	479	-380	116	-72	332	+89
		99		44		421	
	Total	613	+32	210	+24	426	+185
		600		234		611	
Wildlife Analysis Area	High		134		333		2,394
			Moderate		3,084		1,334
			Total		3,218		1,667

Cumulative Effects Bald Eagle

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).

Alternatives 1, 2, and 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

Direct and Indirect

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 resource protection measures 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 resource protection measures 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 (2,554acres in Alternative 2 and 2,248acres 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 3-70. 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 resource protection measures 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 3-70. 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 3-71, 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 3-71. 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	214	150	2	35	216	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	1,028	503	290	463	1,318	967

Following management direction from the 2004 Framework, acres would be added to PACs where mechanical treatments are proposed except as described below (Table 3-72). 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 3-72. 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	214	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	1,028	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 3-73, 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 3-73. 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	Saxon Creek	201	201	201	High	160	195	192	182	197	201	182	197	201
					Moderate	0	0	0	19	4	0	19	4	0

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
Creek					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 3-74, next page, 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 3-74. 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 3-84. 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 resource protection measures) 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 3-75). 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 3-75. 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 (2nd and 3rd 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	Low risk of direct effects to individuals in this recently unoccupied and infrequently occupied PAC. Moderate risk to reproduction (last nested in 2003). 100% of existing PAC to be treated (2nd, 3rd, and 4th 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.

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
Seneca Pond	Angora 1	Moderate risk of direct effects to individuals in this recently but infrequently occupied PAC. Low risk to reproduction (no nests known). 92% of existing PAC to be treated (1st, 2nd, and 4th 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 PAC, which was remapped after the Angora Fire. Improved riparian condition following stream crossing replacement.	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 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 (1st and 4th 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	Moderate risk of direct effects to individuals in this recently and frequently occupied PAC. High risk of direct effect to reproduction (2009 nest tree located within treatment area). 97% of existing PAC to be treated (1st, 3rd, and 4th 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.

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
Hellhole	Hellhole	Moderate 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 (1st, 3rd, and 4th 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 A	Cold Creek	Low risk of direct effects to individuals in this unoccupied and infrequently occupied PAC. Low risk of direct effect to 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.	Same as Alternative 2 except that 160 acres of mechanical thinning would be eliminated from treatments (20% of existing 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.

Cumulative Effects for Northern Goshawk

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.

Alternatives 1, 2, and 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 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

Direct and Indirect

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 resource protection measures 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 resource protection measures are expected to minimize potential adverse effects to spotted owls and their habitat during implementation. Resource protection measures 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 3-76. 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 resource protection measures 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 resource protection measures 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 3-76. 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 3-77, 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 3-77. 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	26	58	51
Hawley Grade	300	0	8	87	19	87	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	578	308	272	297	849	604

Similarly, the numbers of acres of treatments within current spotted owl HRCAs in the wildlife analysis area are presented in Table 3-78, 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 3-78. 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	427	227	115	309	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	218	151	228	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	241	230	250	238
Hellhole	1,000	419	272	140	180	559	452
Cold Creek	1,000	353	131	0	0	353	131
Total	9,000	1,979	922	1,022	969	3,001	2,564

Following management direction from the 2004 Framework, acres would be added to PACs where mechanical treatments are proposed (Table 3-79). 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 3-79. 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	0	8	0	8	300	308
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	578	308	578	308	3,278	3,008

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 3-80, and for HRCAs in Table 3-81, 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 resource protection measures 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 3-80. 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	300	308	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	3,278	3,008	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 resource protection measures 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 3-81. 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 3-82, next page, 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 3-82. 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	300	308	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	3,278	3,008	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 3-83, below. 50 percent canopy cover for HRCAs, rather than 60 percent in PACs, is a resource protection measure 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 3-83. 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 3-84. 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 3-84. 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 3-85. 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 3-75) 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 3-84. 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 3-84. 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 recently 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	Low risk of direct effects to individuals in this recently unoccupied 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	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

PAC	Territory	Proposed Action (Alternative 2)	Alternative 3
		increased from 49% to 59% and acres increased from 147 acres to 183 acres. Canopy cover reduced from 50% to 42%.	increased from 49% to 51% and increased from 147 acres to 158 acres. Canopy cover reduced from 50% 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	Moderate risk of direct effects to individuals in this recently occupied PAC. Low risk to reproduction (historically occupied by a 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 3-85. 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 recently 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.

HRCA	Territory	Proposed Action (Alternative 2)	Alternative 3
Hawley Grade	Benwood Meadow	Low risk of direct effects to individuals in this recently unoccupied 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 mean canopy cover decreased from 47% to 41%.	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 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	Moderate risk of direct effects to individuals in this recently occupied 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%.

HRCA	Territory	Proposed Action (Alternative 2)	Alternative 3
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.

Cumulative Effects for California Spotted Owl

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.

Alternatives 1, 2, and 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 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

Direct and Indirect

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 resource protection measures 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 3-86. 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 3-86. 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	

Cumulative Effects for Great Gray Owl

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.

Alternatives 1, 2, and 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 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

Direct and Indirect

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 two locations that would be treated in both Alternatives, Lily Lake (where this species was detected in 2002 and 2003) and Mattole Rd. in the Spring Creek cabin tract (2010). 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) and 4 acres of suitable habitat adjacent to Mattole and Karok Road 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 resource protection measures 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 3-87. 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 3-87. 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.

Cumulative Effects for Willow Flycatcher

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).

Alternatives 1, 2, and 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 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.

Analytical Conclusions

This section provides a brief summary of the conclusions of the effects analysis for terrestrial wildlife. It summarizes the results of Chapter 2 resource protection measures on the magnitude, scope, and intensity of the environmental effects to terrestrial TES species from project activities. Findings for significance are also summarized in this section.

Under the No Action alternative, 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 to terrestrial species or their habitats.

Alternative 2 would improve forest health and reduce hazards to wildlife and their habitats from wildland fire by creating defensible space around communities within the WUI. 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 wildlife because habitats within the WUI are often less suitable than equivalent habitats located outside the WUI due to the amount of human disturbance.

Alternative 2 includes resource protection measures that consider wildlife resources. All California spotted owl PACs, goshawk PACs, and stands within TRPA goshawk nest disturbance zones would receive specialized thinning prescriptions that retain additional cover to preserve habitat suitability. Residual snag and LWD retention is expected to provide suitable habitats where the existing snag density meets the desired condition. Proposed treatments are designed to increase radial and lateral growth, increase tree species diversity, improve canopy structure, and increase 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 wildlife. Alternative 2 provides refuge for wildlife during implementation and minimizes the level of effects to wildlife in any given year, by scheduling vegetation treatments for treatment stands located in PACs would be scheduled over time, rather than treated all together.

Short term disturbance-related cumulative effects to wildlife are expected, though would be minimized by project resource protection measures. 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 are expected to trend toward desired conditions and the natural range of variability, resulting in improved ecosystem function, resilience to disturbance, and increased productivity. The risk for significant negative effect to terrestrial wildlife species from Alternative 2 is low.

Alternative 3 includes 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.

General cumulative effects would be distributed among wildlife species and across the landscape the same for Alternative 3 as for Alternative 2 except that fewer acres would be treated, slightly reducing the scope of effects. Alternative 3 would have different, and generally more positive, cumulative effects on some sensitive wildlife species as described above. Negative environmental effects are mitigated below the level of significance for terrestrial wildlife by Alternative 3.

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 resource protection measures 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 3-88 (next page) 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 3-88. 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. No nesting activity was recorded for golden eagle at this threshold site through 2010 according to the two most recent threshold evaluation reports (TRPA 2002, TRPA 2007). 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 resource protection measures 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 would 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.

Existing Conditions - 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 will be discussed specific to these individual special interest species.

Northern Goshawk

A total of 36 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 8,508 acres, is subject to TRPA non-degradation standards that would be met through the project resource protection measures 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 36 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.

Osprey

Recording of osprey nesting began in 1976. A total of 60 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 35 standing nest trees within the wildlife analysis area in 2010. The 35 standing osprey nest trees are each buffered by 0.25 mile to designate the 2,444 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 12 (60%) of the 20 trees with nests in 2010, which is above average for the Lake Tahoe Basin. Osprey nesting activity in the wildlife analysis area is summarized below in Table 3-89.

Table 3-89. Osprey nesting activity in the wildlife analysis area, 2010 field season

Nest Name	Nest Condition	Nesting Activity	Nest Name	Nest Condition	Nesting Activity
CSL04	NG		EMB27	NP	Yes
CSL06	NG		EMB28	ND	
CSL07	NG		FLL04	NP	Yes
CSL08	NG		FLL06	NP	Yes
EMB02	NG		FLL14	NP	Yes
EMB05	NP		FLL15	ND	
EMB09	NG		FLL16	NP	
EMB11	NP	Yes	FLL17	NG	
EMB14	NP	Yes	FLL18	NP	Yes
EMB15	NP		RUP11	NG	
EMB17	NG		RUP28	NG	
EMB18	NG		SLT02	NP	
EMB20	NP	Yes	SLT03	NG	
EMB21	NG		SLT05	NG	
EMB22	NP	Yes	SLT06	ND	
EMB23	NP	Yes	SLT07	NG	
EMB24	NP	Yes	SLT08	ND	
EMB26	NP	Yes			

Nest Conditions: NG=nest gone; NP=nest present; and ND=nest dilapidated.

Bald Eagle

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.

Peregrine Falcon

Four previously mapped population sites exist within the wildlife analysis area: Dardanelles, Luther Rock, South Maggie's Peak, and Angora Peak. 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 Rock, Angora Peak, and South Maggie's Peak. Peregrine falcons have been observed nesting only at the Luther Rock site, and only in 2009 and 2010. All sites are located on large, sheer cliff faces.

Waterfowl

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.

Mule Deer

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 7,673 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.

Environmental Consequences - Individual TRPA Special Interest Species

In order to provide clear ties to the individual species that are TRPA special interest species, the effects of the alternatives to wildlife habitats habitat conditions will be discussed specific to these individual special interest species.

Northern Goshawk

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 2,555 acres (29%) in Alternative 2 or 2,248 acres (25%) in Alternative 3 of the 8,879 acres identified as goshawk disturbance zone within the wildlife analysis area. Treatments within the goshawk disturbance zone and PACs are designed to provide the following habitat conditions where possible (otherwise as closely as possible):

- 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

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 470acres (34%) in Alternative 2 or 450 acres (33%) in Alternative 3 of the 1,382 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). Five 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, resource protection measures 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

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 ~162 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

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 Rock 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

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

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.

Analytical Conclusions

This section provides summary of the environmental effects and significance for TRPA threshold habitats and special interest species.

Threshold Standards and Indicators

F-1 Lake Habitat

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, and effects have been mitigated to a level below significance for both action alternatives.

F-2 Stream Habitat

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. Potential for negative effects have been mitigated to a level below significance for both action alternatives.

F-3 In-stream Flow

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[3]

LCT are known to occur in the Upper Truckee River above Christmas Valley at the upper limit of the South Shore project area. This Lahontan cutthroat trout population could be affected by the project if individual LCT migrate into the project area before implementation occurs.

Both action alternatives decrease the amount of combustible fuels within Upper Truckee River RCAs/SEZs, which decreases the potential for future effects on LCT resulting from wildfire. Stream and watershed restoration efforts would also increase aquatic habitat quality for LCT (channel stability, pools, LWD and benthic productivity) over the long-term (> 5 years). The potential for negative effects has been mitigated to a level below significance for both action alternatives.

W-1:Threshold Standard for Wildlife[4]

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 meet the TRPA non-degradation standard. TRPA and LTBMU collaboratively derived resource protection measures have been incorporated into both action alternatives to meet TRPA threshold standards, and effects are mitigated to a level below significance for both action alternatives.

W-2: Habitats of Special Significance

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 would maintain sufficient tree structure in order to supply 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.

[3]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).

[4] 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).

TRPA Special Interest Species

Northern Goshawk

The anticipated impacts of either action alternative 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. Alternative 3 is expected to be more beneficial than Alternative 2. 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. Only 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. Effects have been mitigated to less than significant for both action alternatives.

Osprey

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 following implementation compared to pre-treatment conditions in either action alternative would benefit population sites, because tree density would be reduced and tree health improved for the lifetime of the treatments. Long-term effects are beneficial for ospreys and their habitat.

Bald Eagle

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

There is no meaningful difference between alternatives in effects to peregrine falcons or their habitat. 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 significant effects to peregrine population sites or habitat within disturbance zones are expected.

Waterfowl

No significant 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 impacts of the action alternatives.

Mule Deer

Mule deer fawning habitat would be treated in both action alternatives; 21% in Alternative 2, and 20% in Alternative 3. Disturbance-type effects would occur during implementation. Project implementation in forested stands would reduce shrub and herbaceous cover and forage, but would increase sightlines to predators. Meadows are arguably more important to mule deer fawning, and treatments in meadows and aspen stands would benefit fawning habitat by removing encroaching conifers, leading to increased herbaceous and deciduous cover and forage. 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 because adjacent, untreated habitats would provide temporary movement corridors. Negative impacts are below the level of significance to mule deer or their habitats.

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 FS 2007). Detailed information on the MIS is documented in the SNF Bioregional MIS Report (USDA FS 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 FS 2007a), as listed in Table 3-90. 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 FS 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 3-90.

Table 3-90. 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 FS 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.

Table 3-91. Selection of MIS for Project-Level Habitat Analysis for the South Shore Project

Habitat or Ecosystem Component	CWHR Type(s) defining the habitat or ecosystem component[1]	Sierra Nevada Forests Management Indicator Species *Scientific Name*	Category for Project Analysis [2]
Riverine & Lacustrine	lacustrine (LAC) and riverine (RIV)	aquatic macroinvertebrates	3
Riparian	montane riparian (MRI), valley foothill riparian (VRI)	yellow warbler *Dendroica petechia*	3
Wet Meadow	Wet meadow (WTM), freshwater emergent wetland (FEW)	Pacific tree (chorus) frog *(Pseudacris regilla)*	3
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)*	3
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)*	3
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 obscures)*	3
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*	3
		American marten *(Martes Americana)*	
		northern flying squirrel *(Glaucomys sabrinus)*	
Snags in Green Forest	Medium and large snags in green forest	hairy woodpecker *(Picoides villosus)*	3
Snags in Burned Forest	Medium and large snags in burned forest (stand-replacing fire)	black-backed woodpecker (*Picoides arcticus)*	3

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 coarse 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 dependent 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; hence, the lacustrine and riverine effects analysis for the South Shore Project must be informed by these monitoring data. The sections below summarize the Biological Integrity and Habitat status and trend data for aquatic macroinvertebrates. This information is drawn from the detailed information on habitat and population trends in the 2010 Sierra Nevada Forests Bioregional MIS Report (USDA FS 2010a), which is hereby incorporated by reference.

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). Moyle and Randall (1996) developed a watershed index of biotic integrity (IBI) based on distributions and abundance of native fish and amphibian species, as well as extent of roads and water diversions. According to this analysis, seven percent of the watersheds were in excellent condition, 36 percent were in good condition, 47 percent were in fair condition and nine percent were in poor condition.

Sierra Nevada MIS monitoring for aquatic (benthic) macroinvertebrates (BMI) was conducted in 2009 and 2010 (Furnish 2010). Benthic macroinvertebrates were collected from stream sites during both the 2009 and 2010 field seasons according to the Reachwide Benthos (Multihabitat) Procedure (Ode 2007). The initial BMI data from 2009 and 2010 found 46% (6 of 13) of the surveyed streams indicate an impaired condition and 54% (7 of 13) indicate a non-impaired condition (see USDA FS 2010a, Table BMI-1). This is similar to the IBI conditions estimated by Moyle and Randall (1996). Therefore, current data from the Sierra Nevada indicate that status and trend in the RIVPACS scores appears to be 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 action alternatives 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

Acres of riparian habitat: 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).

Deciduous canopy cover: 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.

Acres of riparian habitat with changes in total canopy cover: 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.

Acres of riparian habitat with changes in CWHR size class: 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 2010 SNF Bioregional MIS Report (USDA FS 2010a, which is hereby incorporated by reference.

Habitat status and trend

There are currently 38,140 acres of riparian habitat on National Forest System lands in the Sierra Nevada. Over the last two decades, the trend is stable.

Population status and trend

Monitoring of the yellow warbler across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science, as part of a monitoring effort that also includes mountain quail, hairy woodpecker, and fox sparrow (USDA FS 2010a, http://data.prbo.org/partners/usfs/snmis/). Yellow warblers were detected on 13.7% of 160 riparian point counts in 2009 and 19.4% of 397 riparian point counts in 2010; additional detections were documented on upland point counts. The average abundance (number of individuals recorded on riparian passive point count surveys) was 0.166 in 2009 and 0.309 in 2010. In addition, the yellow warblers continue to be monitored and surveyed in the Sierra Nevada at various sample locations by avian point count, spot mapping, mist-net, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA FS 2008). 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 [chorus] 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 3-92, 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.

61,247 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 (chorus) 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 (chorus) frog. This information is drawn from the detailed information on habitat and population trends in the 2010 SNF Bioregional MIS Report (USDA FS 2010a), which is hereby incorporated by reference.

Habitat status and trend

There are currently 61,247 acres of wet meadow habitat on National Forest System lands in the Sierra Nevada. Over the last two decades, the trend is stable.

Population status and trend

Since 2002, the Pacific tree (chorus) frog has been monitored on the Sierra Nevada forests as part of the Sierra Nevada Forest Plan Amendment (SNFPA) monitoring plan(USDA FS 2006b, 2007b, 2009, 2010b; Brown 2008) . These data indicate that Pacific tree (chorus) 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 (chorus) 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 either action alternative, 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)

<u>Acres of early and mid-seral coniferous forest</u>: 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 6,776 acres under Alternative 2 and 6,589 acres under Alternative 3. Under Alternative 2, a net loss of 1,234 acres of early and mid-seral coniferous forest (size classes 1-4) would result, and under Alternative 3 the net loss would be 1,035 acres. This type conversion of early and mid-seral coniferous forest represents 5% of all early and mid-seral coniferous forest in the wildlife analysis area for Alternative 2 and 4% 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 1,234 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 5% of all early and mid-seral coniferous forest in the wildlife analysis area. A total of 1,035 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 4% 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 2,576acres (11%) 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 2,536 acres (10%) 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 3-95 and 3-96 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.

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 3-92 and 3-93 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 3-92. Alternative 2 Treatments and effects to understory shrub cover. Acres are not additive as some treatments overlap

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	327	70	229
Whole Tree Removal	Whole Tree Forwarding	0	15	0
Mechanical Thinning	Landing Pile Burning	951	20	190
	Lop and Scatter	0	20	0
	Underburning	104	70	73
Hand Thin	Chipping/Mastication	139	70	97
	Hand Pile and Burn	2,464	6	148

Table 3-93. Alternative 3 treatments and effects to understory shrub cover. Acres are not additive as some treatments overlap

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	382	70	267
Whole Tree Removal	Whole Tree Forwarding	0	15	0
Mechanical Thinning	Landing Pile Burning	227	20	45
	Lop and Scatter	0	20	0
	Underburning	15	70	10
Hand Thin	Chipping/Mastication	231	70	162
	Hand Pile and Burn	2,915	6	175

*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, 25% of treated acres are anticipated to have changes to habitat factors. For Alternative 3 21% of treated acres are anticipated to have changes to habitat factors. In total, an estimated 1,694 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 1,408 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 1,4202 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 ~1,706 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 ~1,420 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 ~1,420 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 ~1,706 acres, and changes to ~3,050 acres (<0.2%) 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 1,234-2,576 acres (~80%) of the 1,706-3,050 acres of early and mid-seral coniferous forest habitat with cumulative effects within the wildlife analysis area. The cumulative effects to 1,706-3,050 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 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 ~1,420 acres and changes to ~2,750 acres (<0.2%) 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 1,035-2,536 acres (~80%) of the 1,402-2,750 acres of early and mid-seral coniferous forest habitat with cumulative effects within the wildlife analysis area. The cumulative effects to 1,420-2,750 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 2010 SNF Bioregional MIS Report (USDA FS 2010a, which is hereby incorporated by reference.

Habitat status and trend

There are currently 530,851 acres of early seral and 2,766,022 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. Over the last two decades, the trend for early seral is decreasing (changing from 9% to 5% of the acres on National Forest System lands) and the trend for mid seral is increasing (changing from 21% to 25% of the acres on National Forest System lands).

Population status and trend

Monitoring of the mountain quail across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science, as part of a monitoring effort that also includes fox sparrow, hairy woodpecker, and yellow warbler (USDA FS 2010a, http://data.prbo.org/partners/usfs/snmis/). Mountain quail were detected on 40.3 percent of 1659 point counts (and 48.6% of 424 playback points) in 2009 and 47.4% of 2266 point counts (and 55.3% of 492 playback points) in 2010, with detections on all 10 national forests in both years. The average abundance (number of individuals recorded on passive point count surveys) was 0.103 in 2009 and 0.081 in 2010. These data indicate that mountain quail continue to be distributed across the 10 Sierra Nevada National Forests. In addition, mountain quail continue to be monitored and surveyed in the Sierra Nevada at various sample locations by hunter survey, modeling, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA FS 2008).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 1,035--1,234acres 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 2,536-2,576 acres of early and mid-seral coniferous forest, 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 403 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 2and three would change someearly and mid-seral forest to late seral open canopy coniferous forest, Under both action alternatives a small amount 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 780 acres (~170%) for Alternative 2 and 769 acres (~173%) 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 144 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 Alternative 2 and 36 for Alternative 3. A change in canopy cover would occur for approximately 8-32% of late seral open canopy coniferous forest within the wildlife analysis area.

Acres with changes in understory shrub canopy closure class: Effects of each unique treatment combination shown in Tables 3-99 and 3-99 on shrub cover have been previously described in the above analysis of direct and indirect effects for early and mid-seral coniferous forest.

Tables 3-94 and 3-95 show 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 3-94. Alternative 2 treatments and effects to understory shrub cover in late seral open coniferous forest. Acres are not additive as some treatments overlap

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
Cut to Length	Chipping and Mastication	0	70	0
Whole Tree Removal	Landing Pile Burning	28	20	6
Hand Thin	Chipping and Mastication	0	70	0
	Hand Pile and Burn	54	6	3

Table 3-95. Alternative 3 treatments and effects to understory shrub cover in late seral open coniferous forest. Acres are not additive as some treatments overlap

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
Cut to Length	Chipping and Mastication	2	70	1
Hand Thin	Hand Pile and Burn	80	6	5
	Chipping and Mastication	0	70	0

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)and Alternative 3

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 on ~64 acres, and creation of as much as 1,096 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 1,003 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 1,096 acres. For Alternative 3 potential changes would be expected on ~59 acres, with the possible creation of 1,003 acres. The cumulative effects of an increase of approximately 1% 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 2010 SNF Bioregional MIS report (USDA FS 2010a, which is hereby incorporated by reference.

Habitat status and trend

There are currently 63,795 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. Over the last two decades, the trend is decreasing (changing from 3% to 1% of the acres 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 36-144 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 769-780 acres of late seral open canopy coniferous forest habitat within the South Shore wildlife analysis area, while contributing to a relatively large (~200%) 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 FS 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 coarse woody debris (Allen 1987). Key components for westside and eastside marten habitat can be found in the Sierra Nevada Forest Plan Amendment FEIS (USDA FS 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.

Large snags per acre: 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.

Large down logs per acre: 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)

Acres of late seral closed canopy coniferous forest: 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.

Acres with changes in canopy closure (D to M): - 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.

Acres with changes in large down logs per acre or large snags per acre: 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

Acres of late seral closed canopy coniferous forest: Alternative 2 would treat approximately 283 acres and Alternative 3 would treat approximately 273 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 260 acres (54%), while Alternative 3 would produce a net increase of 203 acres (42%). Acres with changes in canopy closure (D to M): 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 resource protection measures) 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 resource protection measures, 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 370 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 370 acres of closed canopy coniferous forest habitat. Cumulative effects are expected on less than 0.04% o the 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 70-260acres (~58%) of the 120-370total 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 120-370acres 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 2010 SNF Bioregional MIS report (USDA FS 2010a which is hereby incorporated by reference.

Habitat status and trend

There are currently 1,006,923 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. Over the last two decades, the trend is slightly increasing (changing from 7% to 9% of the acres on National Forest System lands); since the early 2000s, the trend has been stable at 9%.

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; Gutierrez et al. 2008, 2009, 2010; USDA FS 2001, 2004, 2006b; USFWS 2006; Sierra Nevada Research Center 2007, 2008, 2009, 2010). 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 since 1996 (e.g., Zielinski et al. 2005, Moriarty 2009). 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 FS 2005, 2006b, 2007b, 2009, 2010b). 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, although detection rates have decreased in at least some locatized areas (e.g., Sagehen Basin area of Nevada County).

N**orthern 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, 2008, 2009, 2010), and 1958-2004 throughout the Sierra Nevada in various monitoring efforts and studies (see USDA FS 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

California spotted owl: The addition of 203-260 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.

American marten: The addition of 203-260 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.

Northern flying squirrel: The addition of 203-260 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.

<u>Medium (15-30 inches dbh) snags per acre</u>: 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.

<u>Large (greater than 30 inches dbh) snags per acre</u>: 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.

<u>Medium (15-30 inches dbh) snags per acre</u>: 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.

<u>Large (greater than 30 inches dbh) snags per acre</u>: 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 resource protection measures 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 resource protection measures, 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 resource protection measures 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 resource protection measures. 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 2010 SNF Bioregional MIS report (USDA FS 2010a, which is hereby incorporated by reference.

Ecosystem component status and trend

The current 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 1.5 per acre in eastside pine to 9.1 per acre in white fir. In 2008, snags in these types ranged from 1.4 per acre in eastside pine to 8.3 per acre in white fir (USDA FS 2008).

Data from the early-to-mid 2000s 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 (+0.76), white fir (+2.66), productive hardwoods (+0.35), and red fir (+1.25) and decreased within ponderosa pine (-0.16) and eastside pine (-0.14)

Detailed information by forest type, snag size, and snag decay class can be found in the 2010 SNF Bioregional MIS Report (USDA FS 2010a).

Population status and trend

Monitoring of the hairy woodpecker across the ten National Forests in the Sierra Nevada has been conducted since 2009 in partnership with PRBO Conservation Science, as part of a monitoring effort that also includes mountain quail, fox sparrow, and yellow warbler (USDA FS 2010a, http://data.prbo.org/partners/usfs/snmis/). Hairy woodpeckers were detected on 15.1% of 1659 point counts (and 25.2% of 424 playback points) in 2009 and 16.7% of 2266 point counts (and 25.6% of 492 playback points) in 2010, with detections on all 10 national forests in both years. The average abundance (number of individuals recorded on passive point count surveys) was 0.116 in 2009 and 0.107 in 2010. These data indicate that hairy woodpeckers continue to be distributed across the 10 Sierra Nevada National Forests. In addition, the hairy woodpeckers continue to be monitored and surveyed in the Sierra Nevada at various sample locations by avian point count and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA FS 2008). 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). Recent habitat relationship information gathered on several Sierra Nevada National Forests, including the LTBMU, are considered and incorporated by reference (Siegel et al 2009).

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 resource protection measures, 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 resource protection measures 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 resource protection measures. 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 2010 SNF Bioregional MIS report (USDA FS 2010a, which is hereby incorporated by reference.

Ecosystem component status and trend

The current 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 1.5 per acre in eastside pine to 9.1 per acre in white fir. In 2008, snags in these forest types ranged from 1.4 per acre in eastside pine to 8.3 per acre in white fir (USDA FS 2008). Data from the early-to-mid 2000s 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 (+0.76), white fir (+2.66), productive hardwoods (+0.35), and red fir (+1.25) and decreased within ponderosa pine (-0.16) and eastside pine (-0.14).

Detailed information by forest type, snag size, and snag decay class can be found in the 2010 SNF Bioregional MIS Report (USDA FS 2010a).

These data include snags in both green forest and burned forest. Between 2000 and 2007, 211,000 acres underwent severe burn and 176,000 acres underwent moderate burn in the Sierra Nevada.

Population status and trend

Monitoring of the black-backed woodpecker across the 10 National Forests in the Sierra Nevada has been conducted since 2008 in partnership with the Institute for Bird Populations (IBP) (USDA FS 2010a, http://www.birdpop.org/Sierra/bbwo.htm). In 2008, black-backed woodpeckers were detected at 68 survey stations distributed across 10 of the 19 fire areas surveyed. In 2009, black-backed woodpeckers were detected at 169 survey station distributed across 28 of the 51 fire areas surveyed. In both years, occupied sites were well distributed across the Sierra Nevada national forests, included burned areas of a variety of sizes, and included areas 1 to 10 years post-fire. These data indicate that black-backed woodpeckers continue to be distributed across the 10 Sierra Nevada National Forests. Additionally, mean occupancy probability for stations surveyed during 2009 was 0.253 (95% credible interval: 0.222 – 0.289); applying this probability across the 10 national forests yields an estimate that approximately 81,814 ha (25.3%) (range of 71,921 – 93,610 ha) the 323,358 ha of burned forest (burned between 1999 and 2008) on the ten national forest units within monitoring area was occupied by Black-backed Woodpeckers in 2009. In addition, the black-backed woodpeckers continue to be surveyed in the Sierra Nevada at various sample locations by avian point count, spot mapping, mist-net, and breeding bird survey protocols. These are summarized in the 2008 Bioregional Monitoring Report (USDA FS 2008). 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 3-96).

Table 3-96. 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	22,923	-1,234	23,690	-1,035
Coniferous forest, late seral, open canopy[4]	443	1,223	+780	1,212	+769
Coniferous forest, late seral, closed canopy[4]	481	741	+260	684	+203
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 3-101.

Table 3-97. 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	1,234	1,035
CWHR size class	24,157	0	1,234	1,035
tree canopy cover class	24,157	0	2,576	2,536
understory shrub cover	25,157	0	N/D	N/D
Coniferous Forest, late seral, open canopy	443	0	780	769
tree canopy cover class	443	0	142	36
understory shrub cover	443	0	N/D	N/D
Coniferous Forest, late seral, closed canopy	481	0	260	203
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				

Analytical Conclusions

This section provides a summary of the analysis of the environmental effects on MIS from project activities.

Lacustrine/Riverine Habitat (Aquatic Macroinvertebrates)

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.

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. The effects of both action alternatives are below the level of significance.

Riparian Habitat (Yellow warbler)

The change in deciduous canopy closure in 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. The effects are below a level of significance for both action alternatives.

Wet Meadow Habitat (Pacific tree frog)

Trend changes in wet meadow habitat as a result of the both action alternatives, 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. The effects of both action alternatives are below a level of significance.

Early and mid-seral Coniferous Forest Habitat (Mountain quail)

The net loss of 1,035-1,234 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 2,536-2,576 acres of early and mid-seral coniferous forest 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. The effects for both action alternatives are below a level of significance.

Late Seral Open Canopy Coniferous Forest Habitat (sooty [blue] grouse)

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 769-456 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. Effects are below a level of significance for both action alternatives.

Late Seral Closed Canopy Coniferous Forest Habitat (California spotted owl, American marten, and northern flying squirrel)

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, American marten, or northern flying squirrel across the Sierra Nevada bioregion. The effects for both action alternatives are below the level of significance.

Snags in Green Forest Ecosystem Component (Hairy woodpecker)

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. Effects are below a level of significance for both action alternatives.

Snags in Burned Forest Ecosystem Component (black-backed woodpecker)

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. The effects for both action alternatives are below the level of significance.

Sensitive Plants

Scope of the Analysis and Indicators of Effect

None of the species considered here require consultation with the US Fish & Wildlife Service (USFWS), however, *Rorippa subumbellata*, Tahoe yellow cress, is a candidate species for federal listing and exists 256 feet north of stand #40 of the proposed project. This stand is proposed for mechanical treatment in Alternative 2. 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 in this analysis are based on 1) the May 25, 2010 (updated on April 29, 2010) customized 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 2010), and 2) on the USDA Forest Service Pacific Southwest Region's list of sensitive plant species, dated October, 2006. This list is the most current version for the LTMBU. All applicable standards and guidelines from the LTBMU – Land and Resource Management Plan (USDA FS LTBMU 1988) and associated amendments (USDA FS 2004a and USDA FS 2004b), 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 is defined as the action area. The action area is the area of potential direct, indirect, and cumulative effects. The action area can be larger than the physical footprint of the project – the project area. The project area is the area where the vegetation treatments would occur under the action alternatives.

Cover of the sensitive plants within the populations identified in the Biological Assessment for this project would be used as the indicator for effects. Cover is the amount of ground covered by the vertical projection of live plant matter and can be visualized by considering a bird's-eye photograph of the vegetation, and is a common measure to determine effects to plants. A decrease in cover is considered a negative, or adverse, impact and an increase in cover would be a positive impact to sensitive plant species. Plant cover, including that of sensitive species, can decrease if plants are injured or killed or if habitat is changed so as to no longer support the sensitive species.

Design Features have been incorporated in the South Shore FEIS that would minimize or eliminate adverse effects to sensitive plant species. The objective of the Design Features listed in Chapter 2 is to protect sensitive plant populations. Complete species listings and analysis details are given in the Biological Evaluation (BE) for sensitive plants, located in the project file and incorporated here by reference. There are no Threatened or Endangered plant species on the LTBMU, and subsequently, a BA (Biological Assessment), was not required.

Existing Conditions – Sensitive Plants

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 LTBMU plant survey documents 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. These habitats include wet meadows, fens, or granite scree (fens are a wetland-type of ecosystem that are supported by groundwater). Species that do not have potential habitat in the project area are not analyzed in this FEIS. The following Forest Service Sensitive (FSS) botanical species are located within the South Shore project area :

Botrychium acendens, upswept moonwort
Meesia triquetra, three-ranked hump-moss
Meesia uliginosa, broad-nerved hump-moss

The following Forest Service Sensitive (FSS) plant species have suitable habitat[1] within the action area of the South Shore 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
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. *Hutchisonii*, Hutchinson's lewisia
Lewisia kelloggii ssp *kelloggii*, Kellogg's lewisia
Meesia triquetra, three-ranked hump-moss
Meesia uliginosa, broad-nerved hump-moss
Peltigera hydrothyria, veined water lichen
One Candidate for listing exists 256 feet north of stand 40, within the action area of the proposed project:

Rorippa subumbellata, Tahoe yellow cress

The following sensitive plant community was located within the project area of the South Shore Project:

Fen – several fens were located within the South Shore project. Some of the fens had either sensitive (*three-ranked hump-moss or broad-nerved hump-moss*) or special interest plant species (sphagnum). Populations of sphagnum moss are located near Osgood Swamp. Another fen in the Grass Lake research natural area (RNA) exists just south 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.

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[1] Habitat suitability models for LTBMU sensitive species were run using available GIS layers such as elevation, topography, plant community, aspect, canopy cover, parent material, etc against factors that were postulated to be necessary for that plant's survival/reproduction. Habitat models for the LTBMU are still in process of validation, and 'suitable habitat' as used here does not indicate that sensitive plants would be found in these locations. Habitat modeling is a tool to aid in predicting where plants may be found. This allows botanists to visit those suitable habitats to see if plants exist at those locations.

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 2007c)

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 2004b, 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 2004b). 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 2004b, pg 345).

There are several fens found within the South Shore project area. The Angora Fen located in Unit 269 was known prior to project surveys. The Angora Fen has an occurrence of three-ranked hump-moss and an occurrence of broad-nerved hump-moss. Several other fens were found within the project area during project surveys conducted in 2006. These areas are sphagnum fens composed of *Sphagnum* moss species and located adjacent to Osgood Swamp in two treatment stands (184 and 187).

In addition the Grass Lake RNA is located adjacent to the project area. 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.

Environmental Consequences – Sensitive Plants

Direct and Indirect

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. All of these impacts can result in a decrease of cover, a measurable indicator of impact.

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.

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 community composition, loss of suitable sensitive plant habitat, change of hydrologic patterns that affect 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* (Hutchinson's lewisia) and *Lewisia. 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 dependent 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

Effects of project activities are similar for both action alternatives, therefore they will be discussed together.. The direct and indirect effects of project activities 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 includes 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 would 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 Features 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 impacts on soil health and productivity (Jurgensen et al 1997).

There is potential for indirect effects from noxious weeds 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 once weeds have become established, 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 for Alternatives 2 & 3

***Arabis rigidissima* var. *demota* (Galena Creek rock cress):** There would be no direct, indirct, or cumulative effects to Galena Creek rock cress from either action alternative in the South Shore project; Galena Creek rock cress was not located in the project area during surveys.

***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 north of Pioneer Trail in Unit 241 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 unit 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 sensitive plant design criteria (SP-1 through SP-3 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 and the following 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)

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 features would result inno cumulative effects.

***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, one of which is within the South Shore project area. These plots are one acre in size. Regional habitat modeling determined that branched collybia potential is highest for LTBMU within these plots. A Design Feature has been included to prevent direct impact or degradation to the branched collybia monitoring plot within the South Shore project area (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* (Hutchinson's lewisia)**: There would be no direct, indirect, or cumulative effects to Kellogg's lewisia from the South Shore project action alternatives; Hutchinson's lewisia was not located during project surveys.

***Lewisia 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 occurrences of three-ranked hump-moss exist within the footprint of the proposed project known from prior 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 three-ranked hump moss in the South Shore FEIS action area. This includes the project footprint, Grass Lake RNA, and an occurrence of three-ranked hump-moss near the proposed project footprint which is located 2,000 ft from a treatment unit. This bounding was chosen because all of the known occurrences of the species on the LTBMU are near South Lake Tahoe.

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

Present and 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 occurrences of broad-nerved hump-moss known from prior surveys exist within the of the South Shore project area. Project surveys did not locate any additional occurrences. 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 that would be mechanically thinned. The fen would be flagged and buffered. No project activities would occur within the fen or buffer which support the hydrology of the fen. Hand thinning rather than mechanical thinning would occur in the areas adjacent to the buffered area to ensure that no impacts to the fen hydrology due to heavy machinery would occur. No underburning would occur within buffered areas.

Design features would 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 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 as a result of the South Shore project.

***Peltigera hydrothyria* (veined water lichen):** Suitable habitat exists in cold unpolluted streams. Veined water lichen is known on the LTBMU only from a tributary to Upper Echo Lake, was not located during project surveys. There would 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.

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.

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 256 ft from the project area. Design criteria have been developed to eliminate potential impacts to this sensitive plant species. No operations would be allowed near 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 would 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 would occur near Tahoe yellow cress populations. There would 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 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.
- 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 described here 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 would minimize the potential for negative cumulative effects. Because there are no direct or indirect effects there would be no cumulative effects as a result of the South Shore project.

Cumulative Impacts

Alternative 1 – No Action

As mentioned above, there may be some indirect effects on sensitive plant populations and habitat from the No Action Alternative resulting from increased fuel loading across the landscape and increased conifer encroachment into meadows and riparian systems. 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. Modeled climate change in the Basin shows potential increase in temperature and earlier melting of snow over the next 50 years. This may further stress those sensitive species that are found within the project footprint and may require cooler temperatures and insulating snowpack: upswept moonwort, three-ranked hump-moss, and broad-nerved hump-moss.

Alternatives 2 and 3

The following are the past, present, and foreseeable future actions that have affected or may affect botanical resources in the Project area. These actions provide additional specificity than what is described in Appendix A. Past and present activities have already altered sensitive plant occurrences and their habitats. Current management direction is designed to eliminate or reduce possible negative cumulative impacts by protecting known sensitive plants species from direct and indirect impacts.

<u>Past:</u>

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)

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

Present and Reasonably Foreseeable Future Actions 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
Human use and recreation

Upper Truckee River – Sunset Reach (planned 2009-2011 construction)

Lower Upper Truckee HUC - Expected length of restored channel is 12,000 ft

The extent of cumulative effects to sensitive plants depends on the management of potential direct and indirect effects, as well as the attributes of the sensitive plant species located within the project area, their distribution within the project area, and the ability to design future projects with sensitive plant attributes in mind. Adverse cumulative effects are not expected as a result of implementation of the proposed project because resource protection measures have been implemented to provide protection into the project areas (see Resource Protection Measure Table VII – Sensitive Plants).

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 three species are known from the project area. Design Features have been incorporated to the South Shore FEIS that would 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. Hutchisonii (Hutchinson's lewisia)
Lewisia kelloggii ssp kelloggii (Kellogg's lewisia)
Peltigera hydrothyria (Veined water lichen)

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Noxious Weeds

Scope of the Analysis, Indicators, and Issues

Species considered are based on the Lake Tahoe Basin weed coordinating group priorities for invasive and noxious 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 LTBMU 1988), as amended, including the SNFPA EIS and Record of Decision (USDA FS 2004a and USDA FS 2004b), 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. Sightings of noxious weeds adjacent or near the project area should be reported to the Noxious Weed Coordinator. Indicators of implementation of the Resource Protection Measures (RPM) 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 depending on the species present. The objective of the RPMs 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 – Noxious Weeds

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 and noxious 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.

The following table reflects the noxious weeds or their habitat are located within the South Shore project treatment areas:

Table 3-98. Noxious and invasive weed species within 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
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 use, 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.

Environmental Consequences – Noxious Weeds

Direct and Indirect

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 RPMs 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. In addition, there would be no efforts made to control or eliminate invasive and noxious weed species under Alternative 1, although other projects could include activities to control or eradicate noxious weeds.

Alternatives 2 and 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 RPMs 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.

Alternatives 2 and 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.

Analytical Conclusions

This section provides a brief summary of the effects analysis for invasive and noxious weed species, including the magnitude, scope, and intensity of the environmental risks for noxious weeds from project activities.

Effects are similar for both action alternatives, and the direct and indirect effects of both action alternatives would add to the existing factors for invasive and 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. Because of the RPMs for both action alternatives to prevent introduction and spread of noxious weeds, neither action alternative would result in significant effects for invasive and noxious weed species.

Air Quality

Scope of the Analysis and Indicators of Effect

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 eight 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.

The potential impacts of concern to air quality are associated primarily with 1) temporary dust from equipment that is used for the removal of trees and transporting to landings, 2) dust from the surface of roads (both permanent and temporary) from truck traffic, and 3) smoke emissions from the burning of activity-related fuels.

Existing Conditions – Air Quality

The project area lies within the jurisdiction of the El Dorado Air Quality Management District (EDAQMD) which is responsible for the El Dorado County portion of the Lake Tahoe Air Basin. The proposed treatment areas, where both prescribed pile and underburning is proposed, are within and adjacent to the city of South Lake Tahoe and surrounding unincorporated communities.

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 first 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 the cities of Reno and Carson City, Nevada.

Existing air quality and clarity in the Lake Tahoe Basin meets Federal Air Quality Standards the majority of the year, and is valued highly by residents and visitors. Traffic during peak recreation periods causes minor air quality impacts from NO_2 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. Smoke from wildfire within the Lake Tahoe Basin itself can create a significant impact, exemplified by the 2007 Angora Fire (pictured below). Impacts can also occur from wildfires on adjacent Forests. In addition wildfire from more distant locations can impact air quality in the Lake Tahoe Basin such as during the 2008 fire season, when the Lake Tahoe Basin was impacted for over a month by wildfires throughout northern California.

Figure 18. Smoke at the start of the 2007 Angora wildfire

Figure 19. Smoke darkens the sky during the 2007 Angora wildfire

Environmental Consequences – Air Quality

Direct and Indirect

Alternative 1 (No Action)

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 would 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 downwind. 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.

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. 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 issued a warning 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.

Uncontrolled wildfires can contribute relatively large amounts of greenhouse gasses, including carbon dioxide (CO_2) to the atmosphere. Wildfires present a risk for high levels of emissions and associated negative effects to air quality, in part due to the release of carbon that was sequestered in the forest biomass prior to the wildfire. Although Alternative 1 has the greatest potential for negative effects to air quality of the three alternatives analyzed, timing of those effects are not predictable, and would not be measurable at the scale used for modeling climate change.

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. Effects to air quality are largely from fugitive dust and emissions from trucks and mechanized equipment.

The second phase would be piling the fuels followed by prescribed fire (under-story and pile burns). Air quality effects would be both from fugitive dust and burning. Prescribed burning would begin the second year after mechanical operations begin and would be spread over as many as eight subsequent years until residual fuels goals are met. The pollutants that would be released are the EPA criteria pollutants i.e. PM^{10}, $PM^{2.5}$, Carbon Monoxide (CO), Nitrogen Oxides (NO_2), Volatile Organic Carbons (VOCs) and minute quantities of non-criteria air toxics. Spacing of the prescribed burning and mechanical operations over several years would ensure compliance with federally mandated threshold levels for ozone precursors (VOC and/or NO_2) and conformity with the state implementation plan.

Prescribed pile and underburning 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 effects to air quality. Guidelines that would reduce the 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.

A smoke management plan would be approved by the EDAQMD 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 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.

Figure 20. Example of understory burning

Treatment of fuels under Alternative 2 would result in decreased production of smoke and associated greenhouse gas and CO_2 emissions in the event of a wildfire. Because wildfires would become more manageable, associated smoke would be less intense and would produce lower amounts of CO_2, greenhouse gasses, and particulate emissions in shorter durations, as 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 air quality effects from wildfire, including greenhouse gasses and CO_2. Examining four of the largest wildfires in the US in 2002, Hurteau et al (2008) found that, for forest land that experienced catastrophic stand-replacing fire, prior thinning would have reduced CO_2 release from live tree biomass by as much as 98%.

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 and generally greater survival rates for the existing forest. This combination of reduced fuels and higher residual tree survival would also reduce the release of greenhouse gasses and CO_2 and preserve greater amounts of carbon sequestration in the surviving trees in the event of a wildfire as compared to Alternative 1, the no action alternative (Safford et. al 2009).

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) in Appendix B and resource protection measures listed in Chapter 2 are specified for mitigating dust produced from operations. As a result of applying these BMPs fugitive dust would be minimized.

Mechanical equipment used for road maintenance and reconstruction, water trucks for dust abatement and trucks that transport biomass in any form would produce exhaust containing greenhouse gases, including CO_2 and NO_2. Mechanical equipment used in thinning would also produce similar greenhouse gases from engine exhaust. Considering the large project area, exhaust would dissipate quickly and not have measurable effect.

Alternative 3 – Preferred Alternative

The effects of Alternative 3 are similar to Alternative 2. While Alternative 3 treats 532 fewer acres, this would be offset by approximately 800 more acres of hand pile burning due to shifting the prescription from mechanical to hand thinning on some treatment units. With respect to the effects on air quality the differences between the alternatives is minimal and would not be measurable in the scale of the South Shore project area. Air quality effects depend more on the timing and conditions during burning than the total amount of material burned over the life of the entire project. Both alternatives would substantially reduce the expected smoke, including greenhouse gasses and CO_2, as compared to a high intensity wildfire.

Alternative 3 would have a slight reduction in fugitive dust production 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. As with Alternative 2, the resource protection measures for mitigating dust would reduce dust produced from mechanical operations and road use to an acceptable level.

Because Alternative 3 would use fewer miles of road, mechanical equipment used for road maintenance and reconstruction, water trucks for dust abatement and trucks that transport biomass in any form would produce somewhat less exhaust containing greenhouse gases, including CO_2 and NO_2. Mechanical equipment used in thinning would also produce less greenhouse gases from engine exhaust due to fewer mechanical treatment acres in Alternative 3.

Cumulative Impacts

Alternative 1 – No Action

Since no project activities would occur, the air quality would not change from the current condition and there would be no cumulative effects.

Alternative 2 – Proposed Action

Air quality impacts generally do not have long term lingering effects so that effects from past projects listed in Appendix A are no longer evident and would not add to the effects of the South Shore project. Only those projects that temporally overlap with the South Shore project have the potential to generate cumulative effects. The EDAQMD provides oversight on all prescribed burning activities within its jurisdiction regardless of agency. This oversight ensures that atmospheric stability and mixing heights are advantageous for the dispersion of smoke. For this reason there would be no significant cumulative effects from burning operations on other projects when added to the South Shore activities in the project area. Air quality standards would be met by all the concurrent projects in compliance with the EDAQMD.

Fugitive dust generated from the South Shore project will be limited spatially and temporally to where and when equipment is working. There are no other on-going projects that will be in close proximity to operations on the South Shore project that will cumulatively add to dust to the air. There may be some recreational or administrative use of dirt roads that would create some dust, but implementation of BMPs will minimize dust regardless of road users.

Alternative 3- Preferred Alternative

With respect to air quality there are no differences cumulative effects differences between Alternative 2 and 3.

Analytical Conclusions

This section provides a summary of the conclusions from the effects analysis for air quality. It provides linkage from resource protection measures, listed in Chapter 2, to their influence on the magnitude, scope, intensity, and significance of the environmental effects to air quality from project activities.

Under Alternative 1, 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 for adjacent communities for considerable durations (days or weeks). Air quality standards would not be met for the duration of a wildfire. Uncontrolled wildfires can contribute relatively large amounts of greenhouse gasses, including carbon dioxide (CO_2) and Particulate Matter (PM^{10} and $PM^{2.5}$) to the atmosphere. Wildfires present a risk for high levels of emissions and associated negative effects to air quality, in part due to the release of carbon within a short period of time that was sequestered in the forest biomass prior to the wildfire. For both action alternatives, temporary and short-term visibility impacts can be expected in the immediate project area during prescribed fire ignition and would be affected by inversions, as well as wind speed and direction. 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. Production of smoke and associated emissions would occur during pile and understory burning but under an approved burn plan. In comparison to a wildfire, prescribed burning produces smoke in accordance with an approved Smoke Management Plan. PM emissions were modeled using the Fire and Environmental Research Applications Team hand pile calculator.

Treatment of fuels under either action alternative would result in decreased production of smoke and associated greenhouse gas and CO_2 emissions and particulate matter in the event of a subsequent wildfire. Because wildfires would become more manageable, associated smoke would be less intense and would produce lower amounts of CO_2, greenhouse gasses, and particulate emissions in shorter durations, as compared to a larger and more intense wildfire that could occur under current conditions. Vegetation management treatments provide the opportunity on a long-term basis to reduce the magnitude of air quality effects from wildfire, including greenhouse gasses and CO_2.

Fugitive dust could result from thinning operations, such as skidding, loading, and hauling. Fugitive dust caused by construction and use of unpaved roads can produce particulate matter in quantities great enough to impair the visual quality of the air. These effects are localized and would be mitigated by effective dust abatement methods. Contractual requirements for standard road watering procedure would mitigate much of the problem. Best management practices (BMPs) in Appendix B and resource protection measures in Chapter 2 are specified for mitigating dust produced from operations. As a result of applying these BMPs fugitive dust would be minimized. Mechanical equipment used for road maintenance and reconstruction, water trucks for dust abatement and trucks that transport biomass in any form would produce exhaust containing greenhouse gases, including CO_2, NO_2 and PM. Mechanical equipment used in thinning would also produce similar greenhouse gases from engine exhaust. Cumulative effects for smoke, greenhouse gasses and CO_2 would not be measurably different between the action alternatives. There would be a minor reduction in the creation of fugitive dust, due to fewer mechanically treated acres and fewer acres treated overall in Alternative 3.

By adhering to the resource protection measures in Chapter 2, as well as 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 for either action alternative, and effects to air quality would not rise to a level of significance.

Heritage and Cultural Resources

Scope of the Analysis and Indicators of Effect

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 USDA Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region (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 USDA Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region [Regional PA] and 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 – Heritage and Cultural Resources

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.

Environmental Consequences – Heritage and Cultural Resources

Direct and Indirect

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, fire behavior modeling has shown there is the possibility for 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.

Alternatives 2 and 3

Alternative 2 and Alternative 3 contain the same resource protection measures 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 of hand treatments to reduce fuels in sites recommended by the Forest Service archeologist, and consultation with the Washoe Tribe of Nevada and California. 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.

Alternatives 2 and 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 when considered with the past, present and foreseeable future projects listed in Appendix A there would be no cumulative effects from implementation of either of the action alternatives.

Analytical Conclusions

This section provides linkage from resources protection measures, listed inn Chapter 2, to their influence on the magnitude, scope, and intensity of the environmental effects on heritage or cultural resources from project activities.

Due to the unpredictable nature of high intensity wildfire effects, Alternative 1 has potential for irretrievable and irreversible loss of heritage and cultural resources.

The action alternatives would increase the protection of heritage and cultural resources by reducing the likelihood for high intensity wildfire in the project area. Removal of conifer encroachment from aspen stands would enhance the health and integrity of aspen stands where arborglyphs are present. No direct or indirect negative impacts are anticipated because resource protection measures provide that project activities would be controlled through identification and protection of sites, either through avoidance, or implementation of hand treatments to reduce fuels in sites recommended by the Forest Service archeologist, and consultation with the Washoe Tribe of Nevada and California. No significant effects to cultural resources are expected for either action alternative.

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Scenic Resources

Scope of the Analysis and Indicators of Effects

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 between 10,000 and 11,000 acres for the action alternatives. This larger project analysis area includes the hillsides that extend beyond the wildland urban interface (WUI). Management of scenic resources considers background views of the landscape as well as closer foreground and middleground distance zone 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

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 distance zone 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.

Existing Conditions – Scenic Resources

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 top 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 community 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. Both Highway 50 and 89 are designated scenic byways. 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 primarily 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 result of high intensity wildfire can be the loss of valued scenic attributes. 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 valued scenic attribute. 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. (FSH 462 1974)

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. Short term deviations from the VQO are permitted and considered consistent with the VQO ratings. The project area currently meets established VQOs. 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).

Environmental Consequences – Scenic Resources

Direct and Indirect

Alternative 1 – No Action

Alternative 1, the No Action alternative, would result in no short term or direct changes to existing scenic resource conditions or distance zone views. 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. This would represent an increased risk to scenic stability. 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 various distance zone views. 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; including cut-to-length and whole-tree mechanical treatments, and hand-thinning treatments. The short term effects would be visible to varying degrees over a 7-15 year period.

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 would cause a visual impact that exceeds VQO standards, but these activities would 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 resource protection measures, 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 comply with the VQO of retention or partial retention as soon as they were burned. The evidence of cut stumps would be visually apparent when viewed in close foreground range. The action alternatives includes a resource protection measure to limit stump heights to a six-inch maximum (measured from the uphill side of stump) to minimize this visual impact (VQ-3).

Foreground distance zone views are the most sensitive to the effects of proposed management activities. Short-term effects to foreground views are consistent with overall VQO, with recovery expected within 1-3 years. Changes to middleground and background views may occur as a result of implementing the vegetation treatments proposed in Alternative 2, however these changes would not affect the area’s compliance with Forest Plan VQOs nor the perpetuation of identified valued scenic attributes. An indirect effect of implementing Alternative 2 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 scenic effect is less than the effect of smoke associated with a wildfire in the project area if vegetation were untreated. There will be no visual impacts to water clarity resulting from hand treatment activities. 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 Forest Service, LTBMU 2007 unpbl.).

Alternative 3 – Preferred Alternative

The effects to scenic resources of implementing Alternative 3 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. Similarly, there would be a slight reduction in the changes to distance zone views.

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 would 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.

Short term impacts would be limited to foreground views. Background distance zone views would not be impacted during or following treatment activities. Background VQOs would be maintained throughout project. Short term effects to foreground views are acceptable and consistent with overall VQO, with recovery expected within 1-3 years

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 (see Appendix A). Previous forest fuel reduction activities on Forest Service lands and other ownerships have incrementally improved the landscape's resilience to wildfire and incrementally reduced risks to 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 (Safford et al 2009). 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 reduce current risks to scenic stability at the landscape level into the future.

If other ownerships are able to implement treatments while the Forest Service takes no action within the project area, the effects are likely to incrementally reduce risks to scenic stability and valued visual attributes within foreground views, but are unlikely to reduce current risks to scenic stability and valued visual attributes 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 incrementally reduced risks to 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.

Short term effects such as the piling of cut material for future burning would cumulatively be added to the effects of previously approved hand treatment activities. This cumulative effect would remain consistent with established VQOs.

Alternative 3 – Preferred Alternative

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 reduce risks to scenic stability over the next 10 to 25 years.

Analytical Conclusions

This section provides a brief summary of the conclusions of the effects analysis for scenic resources.

Long term and indirect effects of the No Action alternative could result in a decrease in the presence of 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 and existing forest vegetation would continue to compete for scarce water, nutrients, and sunlight resulting in a forest that is increasingly susceptible to insect mortality and wildfire. The probability of stands of live trees dying and/or being killed during wildfire events would increase and would likely result in the loss of the scenic attribute of forested views at the foreground, middleground, and background level.

Previous forest fuel reduction and forest health activities on Forest Service lands and other ownerships have incrementally improved the area's resilience to wildfire and incrementally reduced risks to 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 either action alternative would build on previous treatments and result in change to the landscape of the WUI that would reduce risks to scenic stability over the next 10 to 25 years. Neither action alternative would result in significant direct, indirect, or cumulative effects to scenic resources.

Recreation

Scope of the Analysis and Indicators of Effect

The South Shore project analysis area provides the appropriate scope for analysis of existing recreation conditions and the effects of the alternatives. Indicators of effects are linked to the types of activities that would occur with implementation of the alternatives, including effects from user-created, unauthorized travel routes; access restrictions or closures on areas, trails, and roads; changes in locations for obtaining Christmas trees; and overall recreation experience.

Indicators

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 populations, 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 or over-the-snow 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.

The potential for the establishment of user-created trails is difficult to quantify or assign predictive probabilities because it relates to social factors and even actions of single individuals. Visibility of desired destinations and the appearance of potential “short cuts” relates to the density of vegetation and existing barriers. This analysis will not consider the role that effective trail network design plays in preventing the creation of user-created trails, as trail system design is beyond the scope of the actions being considered in this project.

Access Restrictions or Closures

Administrative forest closures of National Forest System lands are issued for limited time periods in designated areas to protect fragile resource conditions or to protect the public during forest management activities that pose a risk to bystanders. For example, following the Angora Fire, an administrative closure was issued in the burn area to prevent further resource damage from recreational use on freshly burned sensitive soils and to protect visitors from hazards related to damaged trees. Similarly, during vegetation treatment activities the public may be prohibited from entering a work area while equipment is being operated, in order to minimize potential safety risks associated with the management activities.

Christmas Tree Program

In recent years the LTBMU has offered permits to the public to cut Christmas trees from designated areas on National Forest System lands. The designated areas are often in close proximity to neighborhoods or major roads and are located within the Wildland Urban Interface. The opportunity to cut a Christmas tree from the forest is a popular activity in December and is valued by the public. This program has encouraged the public to experience undeveloped National Forest System lands during the winter when they may not ordinarily do so.

Recreation Experience

The overall quality of a visitor or resident's recreation experience is related to the setting in which the experience occurs, the facilities that are provided, and the user's expectations. As a recreation provider, the LTBMU has the ability to manage settings and facilities. The Recreation Opportunity Spectrum (ROS) is a tool that the Forest Service uses to plan for a diversity of recreation experiences ranging from "primitive" to "urban". The ROS is a "macro-scale" planning tool and is not intended for small-scale or site planning. Analysis determines if proposed management activities will alter the ROS classification for an area.

Existing Conditions - Recreation

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 a few hours 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.

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 within one-quarter mile of treatment areas described in the action alternatives, sites listed in italics are within the larger project analysis area but farther than one-quarter mile from a unit proposed for treatment.

-**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 in or within one-quarter mile of treatment areas described in the action alternatives.

-Angora Lake Trailhead
-Fountain Place Trailhead
-*Freel Roadless Area*
-High Meadows Trailhead
-Luther Pass Overflow Campground
-*Meiss Meadow Cabin*
-*Dardanelles Roadless Area*
-*Mt. Tallac Trailhead*
-Sand Pit OHV Area
-Sawmill Pond
-Taylor Creek Snopark

The 2006 National Visitor Use Monitoring project (USDA Forest Service, LTBMU 2006a), 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 on National Forest System lands include viewing of natural scenery.

In addition to National Forest recreation opportunities, California State Parks, California Tahoe Conservancy, 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):

Table 3-99. ROS Classifications in South Shore project area, by acres

ROS Classifications	Acres within project area
Primitive / Non-motorized	43, 067
Semi-Primitive / Non-motorized	5,430
Natural / Roaded	28,166
Rural	7,901
Urban	201

Environmental Consequences – Recreation

Direct and Indirect

Alternative 1 - No Action

Alternative 1, the No Action alternative, would implement no changes within the project area. Current management activities would continue. Alternative 1 would result in no short term, direct, effects to recreation resources.

User-Created Trails

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. The conditions and current potentials for the creation of user-created trails within the project area would remain.

Access Restriction or Closures

No project-related access restrictions or closures would result from the selection of Alternative 1.

Christmas Tree Program

The selection of Alternative 1 would not result in any changes to the current Christmas Tree program.

Recreation Experience

Under Alternative 1, the current quality of recreation experience would be expected to remain. There would be no change to current ROS classifications. The area is in conformance with current ROS classifications delineated in the Forest Plan.

Indirect Effects

Since under the no action alternative no fuels treatments would occur, there is increased risk that a wildfire might occur at some time in the future. It is reasonable to assume that given the right conditions a repeat of the Angora fire is possible. As demonstrated by the aftermath of the Angora fire (Jun 2007), an event of this magnitude has the potential to affect the recreation experience and opportunities.

Alternative 2 – Proposed Action

Implementation of Alternative 2, the proposed action, would have direct effects to the recreation resources within the project area.

User-Created Trails

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 resource protection measures, such as placement of physical barriers, increased signage and where feasible, increased enforcement, to discourage establishment of user-created trails.

Access Restriction or Closures

A short-term, direct effect during project management activities would be temporary area closure Forest Orders 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 National Forest 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.

Christmas Tree Program

Implementation of Alternative 2 would have short term effects on the current Christmas tree 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 would 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 program is Basin-wide and the opportunity to select and cut Christmas trees would not be affected in areas outside of the project area. Areas selected for the program are partially selected based on availability of suitable trees.

Recreation Experience

Management activities within or adjacent to developed recreation facilities have the potential to negatively affect visitor's recreation experience. The action alternatives include resource protection 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 would 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, would alter the visual landscape and the experience of those recreating in these areas following treatment. Resource protection measures, listed in Chapter 2, are incorporated within the action alternatives to return these areas to as "naturally appearing" a condition as practical following use.

No changes to the ROS classification are anticipated as a result of implementing Alternative 2. This alternative conforms to the ROS classifications delimitated in the Forest Plan.

Alternative 3- Preferred Alternative

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 a few exceptions.

User-Created Trails

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 an incrementally greater deterrent to the creation of these trails compared to the proposed action.

Access Restriction or Closures

Fewer temporary public access Forest closures would be required under Alternative 3. This would reduce the temporary negative effects on recreation access associated with Alternative 2 management activities.

Christmas Tree Program

The effects of implementing Alternative 3 on the Christmas tree program are the same as those resulting from Alternative 2.

Recreation Experience

Fewer vehicle trips would be required to implement Alternative 3 compared to Alternative 2. This is due to the reduction in mechanical treatment acres. However this would be somewhat offset by increased hand crew traffic. This incremental reduction in vehicle trips would in turn result in incrementally less traffic congestion on local roadways. 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 would have less effect on recreation experience than the larger landings associated with the whole tree operations proposed in Alternative 2.

No changes to the ROS classification are anticipated as a result of implementing Alternative 3. This alternative conforms to the ROS classifications delimitated in the Forest Plan.

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 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 (the Fallen Leaf trail ATM project proposal is anticipated to be analyzed during NEPA process in 2011), may add to the cumulative effects of the proposed action. Temporary recreation closures to repair or re-route Forest Service system trails within the project area but the result of other projects 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 further reduce public access to dispersed recreation opportunities. 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. 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.

The proposed action resource protection measures to discourage establishment of user-created trails, such as placement of physical barriers, increased signage, and increased enforcement where feasible, would compliment on-going trail access and travel management planning and implementation within the project area. ATM trail planning efforts also serve to discourage the establishment of user-created trails through the maintenance of a high quality Forest Service system trail network.

There is the potential that vehicle traffic associated with implementing the proposed action would be additive to vehicle traffic associated with other land management activities, and have a cumulative effect on traffic congestion and impacts to the quality of recreation visitors' experience. Many management activities manage the time of day and week that project-related vehicle trips occur 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 – Preferred Alternative

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 other projects including the Trail ATM work would 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 would be fewer vehicle trips generated as a result of implementing Alternative 3. The trips that the project would generate would still have the potential to additively contribute to other land management activity - related traffic and cause roadway congestion during peak use periods. This potential cumulative effect could have a negative effect on recreation experiences that are dependent on vehicle travel on designated travel routes and highways.

Analytical Conclusions

This section summarizes the conclusions of the effects analysis for recreation. It provides linkage from resource protection measures in Chapter 2 to their influence on the magnitude, scope, and intensity of the environmental effects on recreation opportunities from project activities.

Alternative 1, the No Action alternative, would result in no short term, direct, or indirect effects to the recreation resources, access or quality of recreation experience within the project area. Existing patterns and volume of recreation use are expected to remain. The existing potential for establishment of user-created trails remains.

For the action alternatives, a short-term, direct effect during project management activities would result from temporary Forest orders closing active thinning areas 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 National Forest System land for dispersed recreation for periods ranging from one to six weeks. During fuels management activities trucks and other equipment would be utilizing public travel routes. These additional vehicles have the potential to increase traffic congestion and negatively affect the driving experience of recreation users within the project area.

The action alternatives include resource protection measures to discourage establishment of user-created trails, such as placement of physical barriers, and increased enforcement where feasible. These resource protection measures would compliment on-going trail access and travel management planning and implementation within the project area. Other resource protection measures would reduce the negative effects of temporary restrictions to forest access by providing advanced public notice of the closures and alternative access options. Potential traffic congestion would be minimized by encouraging management activities to occur during non-weekend days during peak use periods.

The effects of either action alternative are not anticipated to result in a reduction in the overall quality of recreation experience for visitors within the project area. Short-term inconveniences to visitors are off-set by the fact that numerous alternative access points to dispersed recreation opportunities will remain, and management activities adjacent to developed recreation facilities will be timed to occur during non-peak visitation periods where feasible.

No significant effects to recreation resources will result from implementation of any of the alternatives under consideration.

Transportation and Access

Scope of the Analysis and Indicators of Effect

Scope

The transportation system plays a critical role in supporting project activities through providing access to, from, and within treatment units. In addition the road system also provides access to the public and for forest administration beyond the South Shore project. The transportation analysis for this project is limited to the roads in the South Shore project analysis area.

The transportation system includes Forest Service (FS) System roads, temporary roads and landings, plus existing state, county and city roads and streets. The analysis in this section covers the transportation system as means to access the area. The impacts of roads, road maintenance and road construction are covered in detail in each of the appropriate resource sections (Soils, Water and Riparian, Aquatic Wildlife, Terrestrial Wildlife, Recreation).

Indicators

This section analyzes the road system that is proposed for use in the South Shore project as it relates to changes in access to the project analysis area by the public and for Forest Service administration.

Existing Conditions – Transportation and Access

There are a total of 328 miles of State, County, City and Forest Service System roads within the project area (see Table 3-100).

Table 3-100. Jurisdiction of Roads within the Project Area (rounded to the nearest mile)

Jurisdiction	Miles
USFS System	51
El Dorado County	121
City South Lake Tahoe	127
State of California	29
TOTAL	328

The California Department of Transportation (CalTrans) manages and maintains the state 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 within the project area are paved and double-lane.

The Forest Service manages and maintains a system of permanent roads (identified as FS System 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 FS System roads vary based on the purpose and need of the road. They are categorized by an assigned 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). 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 stability, 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 delivery from existing roads, BMPs were applied to all of the remaining Forest System roads within these ATM plan areas. 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.

There also exists a network of old road prisms across the project area, that are not managed as part of the Forest Service Road or Trail System. These are the legacy of human activities over the past 100+ years. They have many origins such as relics of old wagon roads, unbuilt subdivisions on acquired land or decommissioned Forest Service roads. Whatever their origin, they are in various states of condition and use. In some cases they may still be used as a trail, on the other extreme; they are barely discernable and covered with vegetation. Some of these old existing non-system tracks are proposed for use as temporary roads to access activities proposed in the South Shore project.

Environmental Consequences – Transportation and Access

Direct and Indirect

To avoid redundant text and facilitate 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 system related activities for the South Shore project would occur. Therefore, there would be no direct effects from the project. The existing matrix of FS System and non-system unclassified roads would remain the same. Access within the project area would not change. Routine annual road maintenance would continue to occur on some portion of the System roads each year.

The three crossings proposed for reconstruction in Alternatives 2 and 3 would not be reconstructed. This would have the possible indirect effect of reducing access in the future if any of the three crossings were to fail and funds were not available for maintenance or repair.

Alternatives 2 and 3

For both of the action alternatives, most of the project activities would be accomplished on the existing permanent FS System roads. No new permanent FS System roads would be constructed under either Alternative 2 or 3. Out of the total of 328 miles of all roads of all jurisdictions, a total of approximately 112 miles would be needed in Alternative 2, and 108 miles in Alternative 3.

<u>County/City Roads:</u> For both action alternatives, the Forest Service would use only 3.9 miles of City of South Lake Tahoe streets out of a total of 127 miles within the project area. There would be no environmental effects because there would not be a need to improve or reconstruct any of these streets.

There are approximately 38 miles of El Dorado Count/State roads that would be utilized for both action alternatives out of a total of 121 miles in the project area. As with the City streets, there would be no environmental effects because there would not be a need to improve or reconstruct any of these roads.

There is a potential for some Forest Service roads to be expanded or improved at existing intersections with both City, County, and State roads to accommodate the equipment and vehicles that would be used for project activities. Resource protection measures would be applied appropriate to the soil type, grade and alignment that would prevent environmental impacts.

Where native surface Forest Service roads, both permanent and temporary, used in the South Shore project intersect any paved or chip sealed road from any jurisdiction, resource protection measures (Chapter 2) will be implemented that prevent the tracking of soil onto the surfaced road. Consequently there are no environmental impacts associated with road junctions.

Overall there would be no lasting effect on the State/County/City road systems. Traffic may increase temporarily on roads that access active units during different stages of the project. There is no way to estimate the exact increase since it depends on what stage of the project is being implemented. It can be anticipated that in some areas heavy equipment will move in then spend time operating in the forest. During this time service trucks, crew transport, chip hauling trucks etc. will be using the public road system in varying amounts. There may then be a period up to several years with little increased traffic in any given area until the follow up fuels treatments are initiated (primarily prescribed burning). <u>FS System Roads:</u> Of the 51 miles total FS System roads within the project area both action alternatives will use 26.7 miles. In Alternative 2, 15 miles of this will be reconstructed leaving 11.7 that would receive maintenance. In Alternative 3, 11 miles would be reconstructed leaving 15.7 miles receiving maintenance.

The roads to be reconstructed within the project area are either ML 1 or 2 and are administrative in use; none are ML 3 or 4. Reconstruction would not change assigned Maintenance Levels. ML 1 and 2 roads would be used for access in the South Shore project the same. The difference is that ML 1 roads would be closed and placed in custodial care at the conclusion of the project and ML 2 roads will remain open for high clearance vehicles to the public seasonally. At the completion of the project no changes will be made to the current access available to the public. In addition, there are no roads that the public is currently using that will be closed as part of this project.

Implementation of either action alternative would require replacement of three existing permanent stream crossings. One is on an intermittent channel in the Lower Trout Creek watershed (12N01A), one is on an ephemeral channel in the Cold Creek watershed (12N08), and one is on a perennial channel in the Osgood Swamp watershed (12N20). For each of these crossing the design criteria are detailed in Chapter 2 and the environmental consequences are detailed in the appropriate resource section of this chapter (Soils, Water and Riparian, Aquatic Wildlife, Terrestrial Wildlife, etc.). Improvement of these three crossings does not have direct effect on current access, as the crossings are currently open and passable to the public. But because the stability of these crossings would be improved they would be more lasting and resilient to future damage at high stream flows. Therefore it is likely that these crossings will remain passable farther into to the future than if left in their current condition.

As with the State/County/City roads, traffic on Forest System roads will temporarily increase during times when various stages of the project are active. There is no change proposed from the current Maintenance Level objectives assigned to the FS System roads that would be used in this project, consequently access would not be affected at the conclusion of the project. While project operations are active there may be temporary delays and/or detours on FS System roads.

<u>Temporary Roads:</u> Temporary roads would account for approximately eight percent of the total road mileage that would be used for the project but the primary difference in the transportation system between the two alternatives is the length of temporary roads needed to access treatment units.

Alternative 2 proposed to use 15.1 miles of temporary road, and Alternative 3 proposed to use 12.3 miles. In both alternatives two-thirds of the temporary roads would be constructed on old existing road prisms. The use of existing road prisms would reduce impacts from the construction that would be required as the route has already been disturbed in the past.

Construction and use of temporary roads does not affect access to the project area for the public. Since temporary roads would be decommissioned at the end of the season and no temporary roads are proposed for incorporation into the permanent road or trail system, they would not add to the network of roads and trails currently approved. Since motorized vehicles are only allowed on approved routes there would be no change in the authorized motor vehicle routes. There may be some old road prisms, not part of the classified road system, that are currently used by the public for foot or bicycle access within the area. If these are used for temporary roads, decommissioning activities could leave them in a condition that would be difficult to walk or bike, but cross country travel would not be prohibited.

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. Consequently there would be no cumulative effects.

Alternatives 2 and 3

Cumulative effects are similar for both action alternatives. A list of past, present, and reasonably foreseeable actions is found in Appendix A. There are no projects listed that effect a change in road access in the project area. In the past there have been projects that decommissioned roads, The South Shore project may use some of these old alignments for temporary road access, but they would be returned to the decommissioned status at the conclusion of the project. With respect to road access implementation of either of the action alternatives does not cause any cumulative effects.

Analytical Conclusions

This section summarizes the conclusions of the effects analysis for the transportation system that would be used for the project. It provides linkage from resource protection measures in Chapter 2 to their influence on the magnitude, scope, intensity, and significance of the environmental effects from the transportation system.

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. Access on FS System roads would not change from the current pattern.

There would be no permanent changes in access in the project area as a result of implementing either Alternative 2 or 3. While 26.7 miles of FS System roads would be used, neither alternative proposes changing the Maintenance Levels currently assigned to the FS System roads included in the project. No new permanent roads would be built and existing FS System roads would be returned to the assigned Maintenance Levels at the conclusion of the project. There would be no significant effect to access of the project area.

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Economics

Scope of the Analysis and Indicators of Effect

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 the value of 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.

It should be emphasized that the revenues displayed are hypothetical based on estimates of the maximum wood fiber that might be available for sale and are presented for comparison of the alternatives. The actual amount of wood fiber sold and possible income will depend on the market conditions at the time of implementation. The wood fiber that might be available for sale is a byproduct of meeting the fuels and forest health objectives set forth in Chapter 2. No part of any of the Alternatives depends on the sale of wood fiber to implement the project, and there is no project objective for production of commercial products.

Analysis Methods

The economic efficiency of the alternatives was analyzed using the present net value (PNV) of possible revenues and anticipated costs 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.

Project planning costs are sunk costs incurred initially because they are incurred regardless of the alternative selected. Planning cost for the project is estimated at $2,220,000 for all alternatives.

Environmental Effects – Economics

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

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 would not provide additional public benefits to local jobs or income generated from the forest products industry.

Alternative 2 – Proposed Action

Direct Effects

Costs and revenues associated with all alternatives are displayed in Table 3-101. Values in Table 3-102 are expressed in current day dollars. Present net values are discussed below and are summarized in Table 3-109. Activity revenues are the estimated value of wood fiber to be removed from the project as a result of implementing thinning treatments and meeting the residual fuel loading goals. Revenues could 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 could generate an estimated $11,087,000 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 $20,643,000.

Table 3-101 shows the total present value costs for each alternative. Present value revenues for Alternative 2 are estimated to be $10,706,000. Revenue generated from the sale of wood fiber 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 $19,624,000. The present net value for Alternative 2 was estimated at $-8,918,000 for a benefit-cost ratio of 0.55, which indicates that the project costs would exceed the value of the wood fiber. 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 3-101. Costs and Revenues for The South Shore Project, by Alternative

Costs / Revenues, 2008 Dollars	Alternative 1 - No Action	Alternative 2 - Proposed Action	Alternative 3 – Preferred Alternative
Revenues			
Estimated Value of Wood Fiber	$0	$10,706,000	$6,942,000
Costs			
Administrative costs, project preparation and contract administration	$0	$751,000	$708,000
Mechanical Thin	$0	$10,648,000	$8,056,000
Hand Thin and Pile	$0	$3,961,000	$4,766,000
Masticate/Chip Fuels	$0	$1,789,000	$1,883,000
Pile Burning	$0	$1,960,000	$2,341,000
Prescribed Underburn	$0	$347,000	$317,000
Temporary Roads	$0	$83,000	$70,000
Road Reconstruction	$0	$85,000	$57,000
Cost Total	$0	$19,624,000	$18,198,000

Source: South Shore Fuels Reduction and Healthy Forest Restoration Project Economic Spreadsheet

Table 3-102. 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	$19,624,000	$10,706,000	$-8,918,000	0.55
Alternative 3 – Preferred Alternative	$18,198,000	$6,942,000	$-11,256,000	0.38
Source: South Shore Fuels Reduction and Healthy Forest Restoration Project Economic Spreadsheet				

Indirect Effects

Indirect effects of Alternative 2 are additional public benefits such as local employment, income generated from the forest products industry, and energy from 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 3-103 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.

A further indirect effect 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 where understory trees have regenerated causing live fuel buildup of fire ladders and would consist of thinning or understory burning in approximately twenty years.

Table 3-103. 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 - Preferred Alternative	21	$1,481,000

Cumulative Effects

The projected cumulative impacts of this project when combined with other projects of a similar activity in the area would be to further increase employment and contracts to accomplish vegetation management work.

Alternative 3 – Preferred Alternative

Direct Effects

Costs and revenues associated with Alternative 3 are displayed in Table 3-104. Alternative 3 could generate an estimated $7,196,000 in revenues. Total cost for Alternative 3 is estimated at $19,202,000. Table 3-105 shows the total present value costs. The present value cost for Alternative 3 is estimated to be $18,198,000. Revenue generated from the sale of wood fiber is a direct benefit. Alternative 3 would remove an estimated 2,533 CCF of wood fiber in the form of both saw logs and biomass. Present value revenue was estimated to be $6,942,000. The present net value for Alternative 3 was estimated at $-11,256,000 for a benefit-cost ratio of 0.38, which indicates that project costs would exceed the value of the wood fiber. This alternative also produces revenues from thinning only, and 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. The ratio of costs to revenues is higher in Alternative 3 because cut-to-length harvesting systems are more expensive than whole tree systems, and there are fewer acres of mechanical treatment in Alternative 3 than Alternative 2.

Indirect Effects

Indirect effects of Alternative 3 are similar to those discussed for Alternative 2. Table 3-106 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.

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.

Cumulative Effects

The cumulative effects of Alternative 3 would be the same as those described for Alternative 2.

Analytical Conclusions

This section provides a brief summary of the conclusions of the effects analysis to economic conditions, including influence on the magnitude, scope, and intensity of the economic effects from project activities.

The no action alternative proposes no action and produces no economic outputs. No market benefits, (direct, indirect or non-quantifiable) can be attributed to this alternative. Planning costs would be lost.

For both action alternatives, project costs would exceed the value of the wood fiber. 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 fewer acres of mechanical treatment in Alternative 3 than Alternative 2, the ratio of costs to revenues is higher in Alternative 3. Neither of the action alternatives are dependent on the sale of wood fiber, any wood fiber that may be available for sale is a byproduct of meeting the fuel reduction and forest health objectives stated in the Purpose and Need for the project, and any income would depend on market conditions at the time of implementation. Both action alternatives would provide jobs, but the economic value of either action alternative, compared to the entire economy in the South Lake Tahoe area, is not significant.

Special Designated Areas

Scope of the Analysis and Indicators of Effect

Within the boundary of the South Shore project analysis area there are several special designated areas, shown in the table below. There are no designated Wild and Scenic Rivers (WSR) in the analysis area but the portion of the Upper Truckee River within the Dardanelles Inventoried Roadless Area has been recommended for inclusion into the WSR system (USDA FS Tahoe NF and LTBMU Feb 1999).

Table 3-104. Special Designated Areas

Special Area	Acres in Analysis Area
Desolation Wilderness	10,984
Grass Lake Research Natural Area	356
Dardanelles Inventoried Roadless Area	13,932
Freel Inventoried Roadless Area	14,881
Pyramid Inventoried Roadless Area	3,346

No treatments are proposed within the Desolation Wilderness or the Grass Lake Research Natural Area so there are no direct effects on these areas. Additionally there are no treatments planned within or in close proximity to the portion of the Upper Truckee River that has been recommended for WSR status. There are treatments proposed in each of the three Inventoried Roadless Areas (IRA) as shown in the following table.

Table 3-105. Inventoried Roadless categories and activity acres

IRA	Proposed Treatment	Alternative 2 Acres	Alternative 3 Acres	Change
Dardanelles	Hand Treatment	222	202	-20
	Mechanical	9	0	-9
Freel	Hand Treatment	151	136	-15
	Mechanical	0.3	0	-0.3
Pyramid	Hand Treatment	215	227	12
	Mechanical	49	37	-12

In all cases the treatments proposed occur in areas where the IRA and WUI overlap. There are no roads or landings proposed within the IRAs.

Management of IRAs on National Forest System lands is currently the subject of conflicting Federal Court decisions. On November 5, 2009, Regional Forester Randy Moore issued a letter outlining Roadless Area Management Direction for the Pacific Southwest Region (R5) based on delegations made by the U.S. Secretary of Agriculture to the Forest Service. Based on R5 direction the South Shore project is within a class of action that requires review by the Regional Office and notification to the State of California. The State of California has not filed a petition for these IRAs under the 2003 Roadless Rule.

The following analysis is based an assessment of the impacts on the IRA that would affect the roadless character of the IRA. Roadless character is defined for purposes of this analysis, as a permanent change in motorized access within the IRA.

Environmental Consequences – Special Designated Areas

Direct and Indirect

Alternative 1 – No Action

Selection of Alterative 1 would result in no activities within the IRA so there would be no direct effect. Fuel loading would continue to increase and the risk of wildfire would correspondingly also increase both within and adjacent to the IRAs. In the event of a wildfire within the IRA, suppression activities could temporarily impact the roadless character i.e. the construction of dozer fireline. However post fire rehabilitation would likely mitigate any motorized intrusion. While a wildfire could affect the visual or recreational values of the IRAs they would remain roadless and the roadless character would be preserved.

Alternatives 2 and 3

Both action alternatives propose a relatively small amount of treatment activities on the fringes of the three IRAs as listed in Table 3-111 and shown on Map 17. The differences between the two alternatives are not measurable considering the scale of the project so they are considered together in this analysis. Since there would be no roads or landings constructed within the IRAs in either alternative there would be no change in the roadless character. While mechanical treatments would be discernable after thinning operations there would be no new permanent roads or authorized motorized access remaining after the project. The project would not forego any future management decisions for the IRAs and is compliant with all pending litigation regarding roadless policy.

Cumulative Effects

Alternative 1 – No Action

Since no fuel reduction activities would take place as part of the South Shore project there would be no direct effects on the roadless character of the IRAs, therefore there would be no cumulative effects when considering the past, present or foreseeable actions in the analysis area.

Alternatives 2 and 3

There are no past, present or foreseeable actions (see Appendix A) that when added to the activities proposed in Alternative 2 or 3 that would result in cumulative impact that would alter the roadless character of the three IRAs. Since neither Alternative 2 nor 3 would affect the roadless character, implementation of the South Shore project would result in no change from the current situation.

Required Federal Considerations and Disclosures

Environmental Justice

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.

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 randomly distributed throughout the project area, and are intermixed with non-federal lands. In 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. The environmental effects as described in each resource section are connected to the location of the subject resource and not influenced by any current human community distribution.

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).

There are no short term uses proposed in Alternatives 2 or 3 that would reduce long term productivity. As stated in the Purpose and Need (Chapter 1) the South Shore project is designed to reduce the risk of wildfire, promote a healthy forest that is resistant to drought and disease, and restore meadows and aspen stands, thus enhancing long-term productivity of the project area. There would be short term effects as the project is implemented but the design of the action alternatives coupled with the Resource Protection Measures result in no trade off of long-term productivity within the project area.

Unavoidable Adverse Effects

Implementation of any of the three alternatives presented would result in some unavoidable adverse environmental effects such as the creation of smoke during prescribed burning. The design of the action alternatives, Alternatives 2 and 3, combined with the Resource Protection Measures mitigate the effects to a level of impact less than significant. The environmental consequences section for each resource area discusses the consequences in detail.

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.

Under both action alternatives, there would be an irreversible loss of the individual trees that are cut and removed or burned, although some may be repurposed into sawlogs, fuelwood and/or biomass. The site productivity would remain virtually unchanged so there is no irreversible commitment of resources anticipated. The treated landscapes will continue to grow trees and other vegetation, and provide quality habitat and recreational opportunities.

Irretrievable commitments of resources would be only for very short periods, generally during operational periods. Recreational users and wildlife could be displaced from sites where project activities are taking place for short periods of time, generally not lasting more than a few weeks. Some use of these active sites would be irretrievably lost. As the operations moved to new locations, both people and wildlife would return to use the site. Taken in context of the whole project area and duration of the project this irretrievable commitment would be so small as to be insignificant. The sites of active treatment would be small compared to the entire analysis area which includes the areas proposed for treatment and area that is not proposed for treatment. Recreational users would have innumerable options to use other nearby inactive portions of the forest.

Chapter 4 – Monitoring

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 resource protection measures found in Chapter 2 and the prescribed BMPs (Appendix B), and in some cases, to measure their short-term effectiveness at protecting resources. If unacceptable impacts are identified through monitoring, measures would be taken to mitigate impacts and adapt management techniques to protect resources as described in the resource sections below. Project resource protection measures are detailed in Chapter 2 and not duplicated in this section (e.g. operable soil moisture conditions , WS-21).

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 project resource protection measures (termed “design features” in the DEIS) 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 resource protection measures 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 B, with a short description.

Soil, Water and Riparian Resources

Required Monitoring

SEZ Pile Burning

The resource protection measures (aka 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 in a representative sample of SEZ pile burn units to determine whether the resource protection measures were successful in avoiding significant impacts to soil stability, soil productivity, water quality, and riparian plant growth. Monitoring would be implemented for up to 2 years after piles are burned. If the monitoring efforts or visual observations of SEZ areas indicate ash or sediment delivery to a surface water occurs, season of burning may be changed, piles may be moved further from channels, or another comparable mitigation measure may be used to prevent the delivery of piled or burned material to surface waters.

BMP and Resource protection measure Implementation

Implementation monitoring would occur in each treatment unit (or group of similar nearby units), and in 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 includes BMPs and resource protection measures contained in the NEPA document that apply to soil and water quality protection. The checklist would require visits to the treatment units before, during and after implementation to ensure that BMPs and resource protection measures are carried out on the ground as they were prescribed. If implementation monitoring indicates a deficiency in completing all required BMPs and resource protection measures, the contract administrator would be notified and the contractor would be required to take corrective action (whether that is to fix the deficiency where found, or to discuss how to properly implement the BMP or resource protection measure in the future).

Implementation monitoring for select BMPs would also occur prior to a large storm event (1 inch or greater forecasted). A watershed or transportation specialist would review project BMPs and notify the contract administrator if additional BMPs are recommended to disconnect runoff from surface water features.

BMP Evaluation Program

Best management practice evaluation program (BMPEP) protocols developed by the USFS and CA State Water Resources Control Board (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 of randomly selected BMPEP evaluations to meet this target. In addition to the Regional targets, this program requires use of the Prescribed Fire (F25) protocol for up to 5 underburns per year..

Additional BMPEP Monitoring

The DEIS described different triggers for additional BMPEP monitoring than what is described below. However, the timber waiver has now been revised for projects initiated in 2009 or later. Based on comments received from the public, the Lahontan Water Board, and the TRPA, the selection criteria for sites for additional BMPEP evaluations have been revised to be consistent with the latest Timber Waiver revision. The LTBMU and Lahontan Water Board concluded that modifying the additional monitoring triggers, using other criteria instead of reliance only on modeled CWE results, would be more consistent with the 2009 Timber Waiver monitoring requirements, and would provide a higher confidence level for evaluating the effectiveness of the resource protection measures and BMPs for the project.

The following methods would be used to select monitoring sites for additional BMPEP evaluations to comply with the revised Timber Waiver language for 2009, rather than using the CWE results to make this determination.

Focused high risk BMP monitoring would be completed annually at stream crossings and SEZ boundaries to verify and document that protection measures are implemented as prescribed and that they are effectively protecting soil and water quality. The focused “high risk” BMP evaluations would be done in addition to those required to meet the BMPEP regional targets in order to comply with 2009 Timber Waiver attachment O, and would be done in stands adjacent to streamside management zones and at stream crossings (BMPEP Protocols T01, E09, and E14). 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.

If sites beyond the regional target are available each year, the T01 protocol would be followed at 1 to3 additional streamside management zones (i.e., SEZs) present within treatment stands. Sites for this monitoring would be selected based on the potential that project activities may affect soil or water quality, such as proximity of treatments to perennial channels, lakes and ponds, and the presence of steep slopes.

The E09 BMPEP protocol would be followed at each permanent stream crossing replacement (3 total) and at the single intermittent stream crossing that would remain in place over winter. This protocol would be completed at 3 points in time: during installation, after the first major storm event (1 inch, 24 hour storm) and after spring runoff the year following crossing installation.

Finally, the E14 protocol would be followed at 1 to 5 temporary road stream crossings (as available each year) within the treatment stands immediately after installation, after storm events (1 inch or greater) during their use,, and to monitor temporary road stream crossing removal immediately after the crossing is removed and after the first winter season. Ephemeral channel crossings would be selected for this monitoring based on the presence of riparian vegetation, slope, and their proximity and connectivity to intermittent or perennial channels.

Forensic Monitoring

In addition to the detailed monitoring described above, forensic monitoring would be conducted whenever visual observations from the project IDT, Contract Administrator, the public, or regulatory agency staff identify a soil or water quality resource concern. This monitoring would involve evaluation of the resource concern from a watershed specialist, identification and application of corrective actions where needed, and repeated monitoring until the concern has been resolved. When safety of employees is of concern, monitoring would occur as soon as conditions are safe.

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, will 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 6 SEZ treatments (2 whole tree units, 2 cut-to-length units, and 2 hand thinning units), b) installation of 3 temperature loggers associated with each unit type, c) locate temperature monitoring sites above, within and below each selected unit and d) measurement of stream shade at each temperature monitoring location and at two points equidistant between stream temperature monitoring locations.

Stream data loggers record water temperatures during a normal spring to fall flow cycle (May – November) which would encapsulate pre- and post-fuels treatment conditions. Stream temperature would be recorded for 1 – 2 years depending on when units are treated. The following table summarizes the stream temperature monitoring parameters.

Table 4-1. Stream Temperature Monitoring Temperatures (May-November)

WHOLE TREE			CUT TO LENGTH			HAND THIN		
Unit No.	**No. of SEZ Acres**	**No. of Data Loggers**	**Unit No.**	**No. of SEZ Acres**	**No. of Data Loggers**	**Unit No.**	**No. of SEZ Acres**	**No. of Data Loggers**
9	21.63	UU – 1 IU – 1 DU – 1	133/135	1.06	UU – 1 IU – 1 DU – 1	99/56	1.24	UU – 1 IU – 1 DU – 1
192	3.90	UU – 1 IU – 1 DU – 1	343	9.72	UU – 1 IU – 1 DU – 1	82/84	0.10	UU – 1 IU – 1 DU – 1
Unit 22 (alternate)	0.03	UU – 1 IU – 1 DU – 1	186/187 (alternate)	0.20	UU – 1 IU – 1 DU – 1	95 (alternate)	0.11	UU – 1 IU – 1 DU – 1
UU = Upstream of unit IU = Inside the unit DU = Downstream of the units						**TOTAL NO. OF DATA LOGGERS = 18** **TOTAL NO. OF SITES = 6**		

Transportation

Required Monitoring

The mechanism for monitoring and documenting the implementation of all transportation resource protection measures and BMPs would be the implementation monitoring checklist, previously described under the Soils, Water, and Riparian Resource section of this chapter. In addition, Transportation (Roads and Access) BMPs would be included in the sampling pool for the Regional BMPEP program each year.

Some elements of the South Shore Project will require a Storm Water Pollutions Prevention Plan (SWPPP) or Erosion Control Plan (ECP), depending on the required level of permitting. The SWPPP and ECP may include additional monitoring elements required by the permitting agency.

Sensitive Plants and Fungi

Required Monitoring

Sensitive plant monitoring is an ongoing forest-wide program conducted regularly with results reported to the National Resource Information System (NRIS) database. Project Sensitive plant monitoring would occur under this program and not specific to the South Shore Project. A regionally designated fungi monitoring plot exists within the project area. No detections of sensitive fungi have occurred. This plot is monitored periodically and no additional monitoring is required for the South Shore Project.

Invasive Weeds

Required Monitoring

The invasive weed monitoring process would occur similar to monitoring described above for sensitive plants. Invasive weed monitoring is an ongoing forest-wide effort conducted regularly with results reported to the NRIS database. This information is used to help determine effective application of project resource protection measures and potential treatment options. Project invasive weed monitoring would occur under this program and not specific to the South Shore Project.

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Chapter 5 – Consultation and Coordination, Acronyms, Glossary, and References Cited

Chapter 5 is organized under the following subsection headings:

- Consultation and Coordination
    - Preparers and Contributors
        - Interdisciplinary Team Members – USDA Forest Service
        - Other Contributors
    - Consultation
    - Distribution of DEIS Document
        - Notification to Individuals & Organizations
        - Distribution to Additional Agencies and Community Locations
    - Acronyms
    - Glossary
    - References Cited
        - Forest Service Handbooks and Manuals

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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)

Distribution of FEIS Document

Notification to Individuals & Organizations

The following list contains the names of those who have participated in the project public collaboration process, and were notified of the publication of the South Shore Fuel Reduction Final EIS (consistent with 36 CFR part 218, subpart A).

Andrew List,   Nevada Fire Safe Council
Andrew Strain , Heavenly Lake Tahoe Ski Resort
Art Darrow, Fallen Leaf Lake Tract Association
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Ben Pignatelli, League to Save Lake Tahoe
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Mike Volmer, Tahoe Regional Planning Agency
Norma Santiago, Eldorado County Board of Supervisors
Pam Armas, District Superintendent, CA Dept of Parks and Rec, Sierra District
Patricia Sanderson Port, Office of Environmental Policy and Compliance, U.S. Dept. Interior, Office of the Secretary
Peter Tittman
Reid Fisher

Rich Fairbanks,The Wilderness Society
Richard Solbrig, South Tahoe Public Utility District
Rochelle Nason - League to Save Lake Tahoe
Roland Shaw, Nevada Tahoe Resources Team
Sandy Morey, CA Dept. of Fish and Game, Region 2
Sharon Duggan, Attorney, Environmental Prot. Info. Center
Shirley Taylor
Steve Morales , Lake Tahoe Unified School District
Steve Wiard , Sierra Pacific Industries
Susan Statton, Office of Historic Preservation
Ted Thayer, Tahoe Regional Planning Agency
Terri Jamin , City of South Lake Tahoe, Public Service
Tony Appleby
Vada Camacho, California Department of Fish and Game
Vince Puccetti, President, Rainbow Tract Association

Distribution to Additional Agencies and Community Locations

Advisory Council on Historic Preservation, Director, Planning and Review
California Land Management
California Tahoe Conservancy
Caltrans District 3, 703 B St., Marysville, CA
Camp Richardson Resort
DeLaMare Library, University of Nevada, Reno
El Dorado County Library, South Lake Tahoe, CA
Environmental Protection Agency, Region 9, EIS Review Coordinator
Federal Aviation Administration, Western-Pacific Region, Regional Administrator
National Marine Fisheries Service, Habitat Conservationists Division, Southwest Region
State Water Resources Control Board, Water Quality, 1001 I St., Sacramento, CA
Tahoe Rim Trail Association, DWR Community Non Profit Center
USDA Forest Service, Ecosystem Planning/Attn: Appeals

Acronyms

CAR **<u>Critical aquatic refuge</u>:** Forest Plan land allocation from the Sierra Nevada Forest Plan Amendment to designate areas for management emphasis on aquatic resources.

CASQA **California Stormwater Quality Association:** Assists the State Water Resources Control Board (SWRCB) and municipalities throughout the state of California in implementing the National Pollutant Discharge Elimination System (NPDES) stormwater mandates of the Federal Clean Water Act.

CTL **<u>Cut to length</u>**: Method of thinning using mechanical harvester equipment that processes logs and bunches biomass for removal while traveling over a portion of the limbs and tops from the trees harvested. A forwarder self-loads logs with or without branches for transport to a landing as well as biomass that will be removed from the project area usually in the form of chip. Logs are generally not skidded. A chipper at the landing usually processes material into clean chip for manufacturing into oriented stand boards and biomass utilization.

CWD **<u>Coarse woody debris</u>**: Material usually 12 inches or larger in diameter within stream channels or floodplains. Provides fish habitat and floodplain roughness.

CWHR **California Wildlife Habitats Relationships computer program:** Functions as a predictive model of habitat suitability for wildlife species, describing vegetation conditions through metrics such as tree size classes and canopy closure.

EIS **<u>Environmental Impact Statement</u>**: The document required by the NEPA for disclosing to the public the activities and effects of an action by a federal agency.

ERA **<u>Equivalent roaded acres</u>**: 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.

HFRA **<u>Healthy Forests Restoration Act of 2003:</u>** The central legislative component of the Healthy Forests Initiative, containing a variety of provisions aimed at expediting the preparation and implementation of hazardous fuels reduction projects.

HRCA **<u>Home range core area:</u>** 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 **<u>Hydrologic unit code</u>**: 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).

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.

MOU **__Memorandum of understanding:__** A document describing a bilateral or multilateral agreement between parties, to include management actions carried out by the Forest Service, Tribal governments, U.S. government agencies at all levels, and private business entities.

LOP **__Limited operating period:__** A restriction placed on a management action within a specific defined area, as to when during the year an event can take place; a management strategy to reduce disturbance to wildlife species and habitats.

NEPA **__National Environmental Policy Act__**: Law that requires federal agencies to disclose major actions and their environmental consequences to the public.

NWCG **__National Wildfire Coordinating Group:__** A formal collective of wildfire management agency representatives from the USDA Forest Service; four Department of the Interior agencies: Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and the Fish and Wildlife Service (FWS);and State forestry agencies (through the National Association of State Foresters). NWCG's purpose is to coordinate programs of the participating agencies so as to avoid wasteful duplication and to provide a means of constructively working together.

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)

RAWS **__Remote automated weather station:__** A network of semi-permanent data acquisition and transmission towers, transmitting site-specific weather data linked from Geostationary Operational Environmental (GOES) Satellite data. The radio transmission of weather data occur when the user "interrogates" a station with a handheld radio on the designated RAWS frequency, or when weather conditions exceed a predetermined threshold an alert broadcast is transmitted to an a local emergency channel. Reference: http://raws.fam.nwcg.gov/

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 environmental impact statement (EIS).

RNWMS **Regional Noxious Weed Management Strategy:** Management strategy for the U.S. Forest Service in California, developed to address this threat, and to work cooperatively with partners check the spread of weeds statewide. Published in August 2000. Reference: http://www.fs.fed.us/r5/noxiousweeds/

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 (State of CA WQCP 2005).

SNFPA **Sierra Nevada Forest Plan Amendment**: Amendment to the Forest Plans of 11 national forests in the Sierra Nevada mountain range, including the LTBMU. Published in January, 2004 by the Pacific Southwest Region (National Forests in California), Vallejo, CA.
Reference: http://www.fs.fed.us/r5/snfpa/final-seis/index.html

SNYLF **Sierra Nevada (mountain) yellow-legged frog *(Rana sierra):*** a candidate species for listing under the Endangered Species Act (ESA), and as Sensitive on the Region 5 Regional Forester's Sensitive Species List. See the Aquatic Wildlife section in Chapter 3.

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

Aggradation	Aggradation involves the raising of the streambed elevation, an increase in width/depth ratio, and a corresponding decrease in channel capacity. Over-bank flows occur more frequently with less-than-high-water events. Excess sediment deposition in the channel and on floodplains is characteristic of the aggrading river. Often, the cause of aggradation is an increase in upstream sediment load and/or size of sediment exceeding the transport capacity of the channel. (US EPA: http://water.epa.gov/scitech/datait/tools/warsss/sedsource_index.cfm).
Basal area	The cross-sectional area of a single stem, including the bark, measured at breast height (4.5 ft or 1.37 m above the ground)
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.
Desired basal area	The spacing or stocking levels used to guide thinning in order to leave a desired density in developing stands.
Dead fuels (Fire Behavior and Fuels)	Estimating the moisture content of dead woody fuels is critical when predicting fire behavior. Dead fuels are divided into four size classes: 1 hour (flashy fuels), 10 hour (1/2-inch diameter), 100 hour 3-inch diameter) and 1,000 hour (8-inch diameter). In general, the larger fuels take longer to absorb or lose moisture. In general, drier fuels increase the rate of fire spread, fireline intensity, and fuel consumption. Prescribed burns are used to meet a number of resource management objectives. Fire managers rely on fire behavior prediction to determine the optimum conditions for prescribed burning.
Endlining	Moving logs using cables where the log is in full or partial contact with the ground
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.
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.

Forest Development Road
See *Road Categories*

Grapple piling
Use of a track-laying low-ground pressure excavator with a with a thumb and claw, typically mounted on articulating arm. This machine is capable picking up created slash or other material to pile on slopes up to 30%.

Hand removal or thinning
Consists of removing trees with chain saws or lopping shears and piling or scattering the debris in open areas for later burning.

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.

Maintenance Levels (Road management)
Level 5 – Roads that provide a high degree of user comfort and convenience. These roads are normally double-lane, paved facilities.
Level 4 – Roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane.
Level 3 – Roads open and maintained for travel by prudent drivers in a standard passenger cars. User comfort and convenience are low priorities.
Level 2 – Roads open for use by high-clearance vehicles . Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses.
Level 1 – Intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities.

Road management is further defined in Forest Service Handbook (FSH) 7709.58,10,12.3.

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.

Objection The written document filed with a reviewing officer by an individual (or organization) seeking predecisional administrative review of a proposed authorized hazardous fuel reduction project as defined in the HFRA.

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.

Raws Remote Automated Weather Station

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.

Road activity

Road Construction – Supervising, inspecting, building, and all expenses incidental to the construction or reconstruction of a forest development transportation facility, including: location, surveying, and mapping (including the establishment of temporary and permanent geodetic markers in accordance with the specifications of the Coast and Geodetic Survey in the Department of Commerce), costs of rights-of way, and elimination of hazards. (36 CFR 212.1(h)).
Road Maintenance – The upkeep of the entire forest development transportation facility including surface and shoulders, parking and side area structures, and such traffic-control devices as are necessary for its safe and efficient utilization. (36 CFR 212.1(I)).
Road Reconstruction - Activities that result in betterment, restoration, or realignment of a road as defined below.

1. Betterment – Investment in construction activity that raises the traffic-service level of a road or improves its safety or operating efficiency.

2. Restoration – Investment in construction activity required to rebuild a road to its approved traffic-service level.

3. Realignment – Investment in construction activity that results in the new location of an existing road or portion thereof.

Road categories

Forest Development Road – A road wholly or partially within or adjacent to NFS boundary that the Forest Service has authorized and maintains jurisdiction over and that is necessary for the protection, administration, and use of lands under the agency's jurisdiction.

Temporary road – A road associated with timber sale contracts, fire activities, or other short-term access needs that are unnecessary for future resource management and not intended to be part of the forest development transportation plan.

Unclassified road – A road that is not constructed, maintained, or intended for long-term highway use. Such roads include all temporary access construction and other remnants of short-term use roads associated with fire suppression, timber harvest, and oil, gas, or mineral activities as well as travel ways resulting from off-road vehicle use.

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.

Woody biomass The wood product obtained (usually) from in-woods chipping of all or some portion of trees including limbs, tops, and unmerchantable stems, usually for energy production

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