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Sierra Nevada Forest Plan Amendment

Final Supplemental Environmental Impact Statement

Volume 1

Forests with a future

Sierra Nevada Forest Plan Amendment

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Summary

The Supplemental Environmental Impact Statement (SEIS) for the Sierra Nevada Forest Plan Amendment (SNFPA) addresses three problem areas that were analyzed in the Final Environmental Impact Statement (FEIS) for the Sierra Nevada Forest Plan Amendment (January 2001). Specifically, the SEIS focuses on specific components of the following problem areas: (1) old forest ecosystems and associated species, (2) aquatic, riparian and meadow ecosystems and associated species, and (3) fire and fuels management.

The SEIS presents a range of alternatives for amending the land and resource management plans for the Modoc, Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sequoia, Sierra, Inyo, and Humboldt-Toiyabe National Forests and the Lake Tahoe Basin Management Unit. One of the alternatives considered in detail, S1, is the “no action” alternative, which would continue management direction in the January 2001 Record of Decision (ROD) for the Sierra Nevada Forest Plan Amendment. The SEIS includes a discussion of new understanding and new information that has become available since the SNFPA FEIS was completed. The projected environmental consequences of the alternatives are evaluated in detail.

Background

Completed in January 2001, the SNFPA FEIS and ROD was the product of more than 10 years of regional planning efforts for management of the species and ecosystems of the Sierra Nevada bioregion. The Forest Service received more than 200 appeals of this decision. The Chief of the Forest Service (Chief) affirmed the decision but directed the Regional Forester of the Pacific Southwest Region (Regional Forester) to review certain elements of the decision.

In December 2001, the Undersecretary of Agriculture for Natural Resources and Environment (Undersecretary) returned the SNFPA decision to the Forest Service, electing not to conduct a discretionary review. The Undersecretary expressed confidence that the Regional Forester would develop an aggressive plan to respond to the Chief’s appeal decision with an open, public review of SNFPA.

The Regional Forester chartered the SNFPA Review Team (Team) to evaluate the SNFPA ROD and recommend any needed changes in six specific areas. The Regional Forester directed the Team to use an open public process to identify opportunities to

- pursue more aggressive fuels treatments while still protecting old-forest conditions and species at risk,
- improve compatibility with the National Fire Plan to ensure that goals of community protection and forest health are accomplished,
- implement the Herger-Feinstein Quincy Library Group Pilot Project to the fullest extent possible,
- reduce unintended and adverse impacts on grazing permit holders,
- reduce unintended and adverse impacts on recreation users and permit holders, and
- reduce unintended and adverse impacts on local communities.

The Team reviewed the SNFPA ROD and FEIS and supporting documents and gathered information concerning each of the above areas. The Team gathered input from national forests currently implementing SNFPA and former members of the SNFPA interdisciplinary team, held meetings with interest groups, sponsored field trips, and reviewed work products generated by the Regional Office SNFPA Implementation Team. The Team also reviewed the appeals record and the Chief’s appeal decision.

The Team investigated a number of concerns related to the areas identified by the Chief and Regional Forester. During the review, new analytical techniques were developed to provide insight into how management direction was implemented on the ground. Some additional information was collected and compiled concerning species of concern from new research, conservation assessments, and field surveys. While the review was underway, the U.S. Fish and Wildlife Service (FWS) released listing decisions for the California spotted owl and Yosemite toad. The findings of the year-long review are acknowledged in this SEIS. The review is documented in Sierra Nevada Forest Plan Amendment, Management Review and Recommendations (USDA Forest Service Pacific Southwest Region 2003g), which is hereby incorporated by reference.

Purpose and Need for Action

The purpose of the proposed action is to adjust existing management direction to better achieve the goals of SNFPA. The SNFPA Review described above, as well as insight gained from almost three years of implementing SNFPA, highlighted the need for refinements of management direction in the following three broad problem areas originally identified in SNFPA: old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems; and fire and fuels. It also highlighted the need to refine management direction so as to implement the *Herger-Feinstein Quincy Library Group Forest Recovery Act* to the fullest extent that is compatible with other legal mandates.

Old Forest Ecosystems and Associated Species

The Sierra Nevada Ecosystem Project (SNEP) report (chartered by Congress and completed in 1996) found that old forest ecosystems were one of the most altered ecosystems in the Sierra Nevada Region and that the habitat and/or population of some animals associated with old forests was in decline. Accordingly, SNFPA was intended to provide regionally consistent direction for old forest conservation. Specific goals included in the FEIS (volume 1, chapter 1, pages 5-6) were to:

- protect, increase, and perpetuate desired conditions of old forest ecosystems, and conserve their associated species, while meeting people's needs for commodities and outdoor recreation;
- increase the density of large trees, increase structural diversity of vegetation, and improve the continuity and distribution of old forests across the landscape; and
- reverse declining trends in the abundance of old forest ecosystems and habitats for species that use old forests.

The above needs are still valid and must be addressed when making changes to existing management direction. However, the new information concerning species dependent on old forest ecosystems requires consideration. For example, recent analysis of California spotted owl populations in four study areas within the Sierra Nevada can better inform judgments about the current population status and risks of actions to reduce hazardous fuels. Owl reproductive data for the spring 2002 breeding period shows a pulse in reproduction that was not considered in the FEIS.

After reviewing the best available scientific and commercial information available, in February 2003 FWS announced that listing of the California spotted owl as an endangered species was not warranted. In that finding, the use and availability of owl habitat on private lands was documented (see chapter 3 for a summary of that info). The finding also assumed that management of the national forests in the Sierra Nevada was based on the SNFPA.

California continues to have significant problems with wildland fire and forest health. Decades of fire exclusion have produced overcrowded vegetation in many forests, which has weakened trees and made them more fire prone and more susceptible to pests, diseases, and displacement by invasive species. The number and severity of wildfires continues to increase. Using historic fire data and recent trends, habitat losses are expected to increase on the average. More importantly these losses are likely to result from significant fire events that cause significant impacts to habitat in a concentrated location. There is a need to reduce expected habitat losses to a rate at least equal to replacement by treating enough acres with enough intensity to significantly modify fire behavior. The SNFPA Review indicated that adjustments to management direction would improve the Forest Service's ability to accomplish this goal.

Aquatic, Riparian, and Meadow Ecosystems

SNEP found that aquatic, riparian, and meadow ecosystems are the most degraded of all habitats in the Sierra Nevada, although much of this problem was seen to be related to lower elevation dams and diversions. In addition, many aquatic and riparian-dependent species, such as willow flycatcher and Yosemite toad, were found to be at risk of extirpation. SNFPA was intended to provide regionally consistent direction to address these problems. Specific goals were to

- protect and restore desired conditions of aquatic, riparian, and meadow ecosystems in Sierra Nevada national forests; and
- provide for the viability of species associated with those ecosystems.

The above needs are still valid and must be addressed when making changes to existing management direction. However, new information must be considered concerning the population status and distribution of Yosemite toad and willow flycatcher, which was gained from two years of field surveys conducted according to established protocol. The recently completed conservation assessment for the willow flycatcher includes updated information about the status of the species and possible refinements to management and restoration of suitable habitat. This information reinforces the importance of considering local data and conditions when planning projects in flycatcher habitat.

An assessment of the reduction in grazing activity that would result from implementing FEIS standards and guidelines for meadows and meadow-associated areas was completed during the SNFPA Review. Accordingly, the SEIS considers changes to management direction that would require the development of site-specific grazing strategies, to allow more economic benefits to be retained while continuing to minimize risks to sensitive species.

Fire and Fuels

The SNFPA FEIS recognized that wildland fire poses a major threat to life, property, financial resources, and natural resources in the Sierra Nevada. In addition, the continued and rapid growth of the region's human population continues to increase the risk of loss of life and property from wildfires, unless hazards are mitigated. The SNFPA was intended to provide a coordinated strategy for addressing the risk of catastrophic wildfire that resulted from decades of fire suppression and the resulting build-up of hazardous fuels. Specific goals were to

- reduce the wildfire threat to human communities and ecosystems and natural resources,
- maintain ecosystem functions, and
- decrease the cost of fire suppression.

These goals remain valid and must be addressed when making changes to existing management direction. However, since the ROD was signed, changed circumstances must be considered in framing management direction to attain these objectives.

The National Fire Plan represents a collaborative approach to wildland fire management that has broad support from the Administration, Congress, the Western Governors, and many other local and regional groups. In May of 2002, the Secretaries of Agriculture and Interior and the Western Governors developed an implementation plan for this collaborative effort. It encourages local Forest Service units to work collaboratively with state and local agencies to accomplish the desired outcomes of this plan. The Regional Forester is committed to achieving the goals of the National Fire Plan and wants management direction for the Sierra Nevada forests to contribute to achieving the goals and meeting the performance measures of the implementation plan.

On December 3, 2003, HR 1904, The Healthy Forests Restoration Act of 2003 was signed into law. The legislation provides new tools and additional authorities to treat more acres more quickly. The Act intended to help expedite projects aimed at restoring forest and rangeland health by providing streamlined administrative decisions and provide courts direction when reviewing fuel reduction or forest health projects. Management direction for the Sierra Nevada must be compatible with this legislation to treat more acres.

The SNFPA Review identified aspects of the existing management direction that must be refined to achieve this goal. Stated briefly, fuels treatments must significantly lower wildfire intensity and rate of spread, thus directly contributing to more effective suppression and smaller acreage burned. Hazardous fuels must be treated in a cost-efficient manner to maximize program effectiveness. Fuels management must actively restore fire-adapted ecosystems by making demonstrable progress in reducing the acreage of unnaturally dense forest (i.e. changing a substantial acreage from Fuel Condition Class 2 or 3 to Condition Class 1).

The SNFPA Review also recognized that the by-products of mechanical thinning present an economic opportunity for local communities. The Review identified measures to assess the degree to which fuels reduction programs are creating local economic benefits. Increasing the economic value of fuel treatment byproducts would also improve the Forest Service's ability to treat the desired acreage of hazardous fuels with available appropriated dollars.

The SNFPA Review Team identified a need to more fully consider three critical aspects of the fire and fuels management strategy established in SNFPA. Selected standards and guidelines need to be adjusted to ensure that certain post-treatment conditions can be met. In particular, fuels treatments must

- be strategically placed across the landscape,
- remove enough material to cause wildfires to burn at lower intensities and slower rates of spread in treatment areas compared to untreated areas, and
- be cost-efficient, so program goals can be accomplished with available appropriated dollars.

The Review Team's analysis identified the prescriptive nature of the existing standards and guidelines for vegetation management to be a primary barrier to meeting these three needs. This potential problem was recognized in the FEIS by a statement concluding, "Modified Alternative 8 would have stand level structural requirements that could preclude full implementation of the fuels strategy" (FEIS volume 1, "Summary," page 29).

The SNFPA Review identified the need to adjust the existing fuels management direction to make it less complicated and costly to implement. To meet that need, standards and guidelines must allow a wider array of tools and techniques for meeting fuels reduction objectives and better respond to local resource conditions in a cost-effective manner. In addition, the FEIS's emphasis on prescribed burning for initial treatments needs to be reduced because of public concerns about smoke and because of the limited number of permissible burn days under state air quality management rules.

Implementation of the Herger-Feinstein Quincy Library Group (HFQLG) Forest Recovery Act Pilot Project

Within the Sierra Nevada bioregion, a number of special plans and projects are underway to test alternative management strategies. Some of these were explicitly recognized in the ROD and were allowed to continue unimpeded by new direction in SNFPA. However, the ROD did not make provisions for the HFQLG Pilot Project to continue in its original form. Instead, the ROD imposed new land allocations, new standards and guidelines for sensitive species, and a new fire and fuels strategy, and it eliminated the project's program of group selection (except as part of an administrative study). Under the SNFPA ROD, the rate of implementation of DFPZs was approximately 40% per year of what was envisioned by the Act and approximately 12% per year for group selections.

The pilot project was intended to produce information needed to reduce scientific uncertainty concerning environmental effects of certain forest management activities. However, the SNFPA Review found that, collectively, the standards and guidelines in the ROD limited this learning from occurring and, therefore, compromised the adaptive management strategy. In addition, the Review Team found that HFQLG's goal of commodity production was also affected by the ROD, by making no provision for regeneration harvest to continue within or outside of the HFQLG pilot project area. In light of these findings, the current management direction needs to be adjusted to better reconcile the goals of the HFQLG Pilot Project with those of the SNFPA and its adaptive management component.

Proposed Action

The proposed action responds to changed circumstances and information identified in a year-long review of SNFPA. The following is a general overview of the proposed action. It is described in more detail as *Alternative S2* in chapter 2.

The proposed action replaces the standards and guidelines of the existing SNFPA strategy for fire and fuels with direction that provides flexibility needed at the local level to effectively modify wildland fire behavior. Opportunities are also provided to allow for generation of by-products. By-product production would offset the cost of fuels treatment and allow the desired program level acreage of hazardous fuels to be treated. In addition, the basic fire and fuels strategy provides for other important objectives, such as reducing tree stand density to improve forest health, restoring and maintaining ecosystem structure and composition, and restoring ecosystems after severe wildfires and other large catastrophic events. The resulting integrated strategy is designed to be aggressive enough to minimize risks to communities from wildfire in the urban-wildland interface and to adequately address the threats to wildlife of catastrophic wildfires across broader landscapes. This strategy must be balanced with the need to ensure that wildlife and other resource values are protected today and in the future.

The proposed action also provides for implementation of the HFQLG Forest Recovery Act Pilot Project.

The proposed action includes new standards and guidelines for willow flycatcher habitat, Yosemite toad habitat, great gray owl protected activity centers, as well as grazing utilization standards to better reflect the wide array of site-specific conditions and the management opportunities they may provide.

The proposed action clarifies management intent for off-highway vehicles; applies the requirement for limited operating periods only to vegetation management activities; and clarifies applicability of several riparian standards and guidelines to recreation activities, uses, and projects. These changes are proposed to more closely align management direction with management goals established in SNFPA.

Responsible Officials and Decision to be Made

The Regional Foresters for the Pacific Southwest Region and the Intermountain Region are the responsible officials for amendment of the SNPFA. The Chief has delegated signing authority for the Intermountain Regional Forester to the Regional Forester for the Pacific Southwest Region.

The decision to be made is whether to amend the Land and Resource Management Plans for the Humboldt-Toiyabe, Modoc, Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, Sequoia, and Inyo National Forests and the Lake Tahoe Basin Management Unit.

Public Participation

No formal public scoping period was held or required for the Draft SEIS; however, the extensive and open public process used to complete the SNFPA Review informed development of the proposed action. The Review was a transparent and highly collaborative process conducted by local Forest Service employees working with a host of key stakeholders, including elected officials, tribes, interest groups and other government agencies. Insight was obtained from dozens of public meetings, workshops, and field trips held with employees, interest groups, scientists, other government agencies, journalists, and others. An Internet website and biweekly electronic news brief were developed to keep the public informed throughout the Review. The issues identified in the SNFPA FEIS (volume 1, chapter 1, pages 12-16) reflect the broad areas of concern, debate and disagreement that also surfaced during the Review.

From early June through August, 2003, extensive efforts were made by national forest leaders to highlight management proposals and encourage public comment on the Draft SEIS. Each Forest Supervisor strongly attempted to engage the local communities through a variety of programs and comment opportunities during this period. The majority of those contacted were interested in the proposals and clearly some groups expressed high interest in the proposed management actions. Each national forest worked with the general public, elected officials, Resource Advisory Councils (RAC's), Native Americans, special interest groups, the media, and other people in their local area.

Forest Service and Tribal Relations

The relationships of the Forest Service with American Indian tribal governments, communities, and organizations are important in the management and restoration of ecosystems in the Sierra Nevada and Modoc Plateau. Tribal representatives participated in the Sierra Nevada Framework Management Review and Supplemental EIS process through interagency team meetings, workshops, field trips, and presentations. The Forest Service continues to work with tribal governments through forest level government-to-government consultation to seek increased opportunities to implement the nine commitments of the SNFPA that were included in the Record of Decision (pages 52-53). At the regional level, annual Sierra Nevada tribal summits are co-hosted, on a rotating basis, by local tribes and forests. At these tribal summits, relationships and communication networks are strengthened through local examples of SNFPA commitment accomplishments and updates of work-in-progress.

The Alternatives

The Final SEIS considers 9 alternatives in detail: the no action alternative (Alternative S1), the proposed action (Alternative S2), and seven action alternatives from the FEIS (Alternatives F2-F8). The no action alternative (Alternative S1) continues management in the 11 Sierra Nevada national forests consistent with the Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD, January 2001). Alternative S2 proposes specific changes to the SNFPA ROD to respond to direction from the Chief of the Forest Service and the Pacific Southwest Regional Forester described above under “Background.” Alternatives 2 through 8 of the SNFPA FEIS are briefly described in the SEIS as Alternatives F2-F8. Readers can refer to the SNFPA FEIS, Volume 1, Chapter 2, pages 83-164, for more detailed descriptions of these alternatives.

Alternative S1 (No Action)

The no action alternative (Alternative S1) would continue management in the 11 Sierra Nevada national forests consistent with the Sierra Nevada Forest Plan Amendment (SNFPA) Record of Decision (ROD, January 2001). Alternative S1’s approach for conserving old forest ecosystems and associated species and managing fire and fuels responds to concerns that impacts from mechanical fuels treatments may pose greater risks to habitats, particularly in the short-term, than the risks posed by potential wildland fires. As such, Alternative S1 applies a conservative approach for conducting activities in habitats for sensitive species, particularly species associated with old forest ecosystems. Alternative S1 includes standards and guidelines for retaining canopy cover and limiting the sizes of trees that can be removed during fuels treatments and imposing limited operating periods for activities within the vicinity of nest and den sites. Under Alternative S1, vegetation treatments are focused on fire hazard reduction, maintenance activities, and public health and safety.

The No Action Alternative also provides direction for limiting and, in some cases, eliminating grazing from habitat that is or has been occupied by the Yosemite toad and willow flycatcher. This alternative applies limited operating periods to vegetation management activities in the vicinity of California spotted owl and northern goshawk nest sites and forest carnivore den sites. Limited operating periods may apply where analysis of proposed projects or activities determines that such activities are likely to result in nest or den site disturbance.

Alternative S2 (Proposed Action, the Preferred Alternative)

Under the proposed action (Alternative S2), Forest Service managers would use thinning, salvage, and prescribed and natural fires to make forests less susceptible to the effects of uncharacteristically severe wildfires, as well as invasive pests and diseases. Goals established in the SNFPA ROD for conservation of old forest ecosystems and associated species would be retained. However, this alternative also provides for other important elements of old forest ecosystems, including the objectives of reducing stand density and regenerating shade intolerant species.

Alternative S2 would adopt an integrated vegetation management strategy with the primary objective of protecting communities and modifying landscape-scale fire behavior to reduce the size and severity of wildfires. This alternative would provide for the removal of some medium-sized trees to increase the likelihood of accomplishing program goals with limited funding. Alternative S2 acknowledges the role that the Forest Service plays in providing a wood supply for local manufacturers and sustaining a part of the employment base in rural communities. This alternative would address the need to retain industry infrastructure by allowing wood by-products to be generated from fuels treatments and for dead and dying trees to be salvaged after wildfires. This active approach to vegetation and fuels management accepts the risks of temporarily changing some habitat for California spotted owls and other species to reduce the future risk of wildfire to habitat and human communities.

Alternative S2 would include the SNFPA ROD's network of land allocations, with some modification and clarification of the associated desired conditions. Alternative S2 would replace some of the standards and guidelines in the SNFPA ROD pertaining to old forest ecosystems, associated species conservation, and fire and fuels management. Alternative S2's standards and guidelines would give greater flexibility to local managers to design projects to respond to local conditions, while meeting desired future conditions unique to each land allocation.

Pending completion of the forest plan amendments/revisions required by the HFQLG Forest Recovery Act, vegetation management activities on the Plumas and Lassen National Forests and the Sierraville Ranger District of the Tahoe National Forest would be guided by the direction of Alternative S2. Alternative S2 provides for implementation of the HFQLG Forest Recovery Act Pilot Project and employs the land allocations specified in the Act for the life of the pilot project. As in Alternative S1, vegetation management in riparian areas within the HFQLG Pilot Project Area would be handled under the SAT guidelines for the life of the pilot project.

Alternative S2 also includes standards and guidelines for managing grazing within habitat that is or has been occupied by the Yosemite toad and willow flycatcher. This management direction is designed to allow local managers to develop site-specific approaches to meet overall program goals for species conservation. Some flexibility is provided to allow managers to take advantage of unique opportunities that can only be identified at the project-level. This alternative would invoke limited operating periods for vegetation treatments in the vicinity of nest sites for California spotted owl and northern goshawk and near furbearer den sites.

Alternative F2 (FEIS Alternative 2)

Alternative F2 establishes large reserves where human management is very limited, to maintain and perpetuate old forest, aquatic, riparian, meadow, and hardwood ecosystems. Alternative F2 responds to views that ecosystems should be protected from all but minimal human-caused disturbances and conditions that "nature" delivers are desired.

Alternative F3 (FEIS Alternative 3)

Alternative F3 emphasizes restoration of desired ecosystem conditions and ecological processes through active management determined through landscape analysis, monitoring, and local collaboration. Management activities would promote ecosystem conditions and ecological processes expected within natural ranges of variability under prevailing climates.

Alternative F4 (FEIS Alternative 4)

Alternative F4 emphasizes the development of forest ecosystem conditions that anticipate and are resilient to large-scale, severe disturbances, such as drought and high intensity wildfire, common to the Sierra Nevada. The alternative is consistent with the view that ecosystems should be actively managed to meet ecological goals and socioeconomic expectations. Alternative F4 would have the greatest number of acres available for active management including timber harvest.

Alternative F5 (FEIS Alternative 5)

Alternative F5 limits impacts from active management through range-wide management standards and guidelines. Alternative F5 preserves existing undisturbed areas and restores others to achieve ecological goals. Alternative F5 emphasizes reintroducing fire as a natural process and using fire to reduce fires and fuel accumulations.

Unroaded areas larger than 5,000 acres, ecologically significant unroaded areas between 1,000 and 5,000 acres, and inner zones of riparian areas would be persevered and left to develop under natural processes. Other areas, including old forest emphasis areas and general forest, would be restored under a limited active management approach to increase the amount of, and enhance processes associated with old forest conditions. Alternative F5 limits impacts from management activities by specifying range-wide management standards and guidelines.

Alternative F6 (FEIS Alternative 6)

Alternative F6 integrates desired condition for old forest and hardwood conservation with fires and fuels management. This alternative provides direction for implementing a landscape-scale strategic fuels treatment program in high-risk vegetation types across Sierra Nevada landscapes to: (a) reduce the potential for large severe wildfires, and (b) increase and perpetuation old forest and hardwood ecosystems, providing for the viability of species associated with those ecosystems.

Alternative F7 (FEIS Alternative 7)

Alternative F7 aims to establish and maintain a diversity of forest ages and structures over the landscape in a mosaic approximating patterns that would be expected under natural conditions, that is conditions characterized by current and expected future climates, biota and natural processes. Ecosystems and ecological processes would be actively managed to maintain and restore them to desired conditions. Silvicultural treatments could produce timber and other forest products.

Alternative F7 relies on few land allocations, applying what is commonly termed a "whole forest approach." Most lands are designated in the "general forest" land allocation where active management is used to move landscapes toward desired conditions. Management is linked to desired conditions for California Wildlife Habitat Relationships (CWHR) stages and old forest condition goals, specific to the major Sierra Nevada forest types.

Alternative F8 (FEIS Alternative 8)

Alternative F8 emphasizes a cautious approach to treating fuels in sensitive wildlife habitat. New information from research and administrative studies would be developed to reduce uncertainty about the effects of management on sensitive species. Until further guidelines were developed, treatments in suitable California spotted owl habitat would retain specific levels of large trees, canopy cover, canopy layers, snags, and down woody material.

Environmental Consequences

This section compares the alternatives by summarizing their environmental consequences. Note that environmental consequences for Alternatives F2 through F8 are fully described in the SNFPA FEIS and are only repeated in part in the SEIS.

Old Forest Ecosystems

All of the alternatives would maintain and enhance old forest conditions across Sierra Nevada landscapes. However, they would have different effects on:

- amounts and distribution of old forest conditions,
- potential losses of old forests to wildfire, and
- old forest ecosystem functions and processes.

Amount and Distribution of Old Forest Conditions

The number of large, old trees would increase under all alternatives. With a few exceptions for specific vegetation types or land allocations, all alternatives would have similar effects on the number of large, old trees because the upper diameter limit for tree removal would be 21 inches on the eastside and 30 inches on the westside (table S1). The exceptions to these diameter limits are:

- Alternative S1 - Tree removal also would be limited to 12 inches in old forest emphasis areas and 20 inches in general forest and threat zones.
- Alternatives F3, F5, and F8 - In eastside mixed conifer and subalpine types, the upper diameter limit would be 24 inches.
- Alternative F4 - After 15-20% of national forest lands reach old forest conditions, trees greater than the 30-inch dbh limit could be harvested.

Table S1. Comparison of Large Tree Retention and Old Forest Connectivity among the Alternatives.

Variable	Alternative								
	S1	S2	F2	F3	F4	F5	F6	F7	F8
Upper diameter limit for tree removal	30” west 24” east	30” west 30” east	30” west 21” east	30” west 21” east	30” west na east	30” west 21” east	30” west 21” east	defined by CWHR classes	30” west 21” east
Percent change in numbers of large trees by 2nd decade	+5.5%	+5.5%	+4.7%	+4.5%	+3.3%	+5.2%	+5.1%	+3.7%	+5.7%
Acreage of old forest allocation (millions of acres)	1.636	1.636	4.873	1.337	0.713	1.745	1.605	defined at project level	2.319

Note: west = westside; east = eastside

Alternatives S2 and F4 would include a larger upper diameter limit on the eastside (30 inches). This could result in tree removal in eastside habitats, which would prolong the time to increase old forest conditions. However, Alternative S2 would require that 30% of the pre-treatment basal area be retained in eastside habitats. This standard and guideline would help to maintain a component of older, larger trees. Alternative F7 would have tree diameter limits that vary by CWHR type.

All alternatives are designed to protect and maintain blocks of old forests (table S1). Alternative F2 would meet this goal by establishing biodiversity reserves. The other alternatives would use the old forest emphasis land allocation for this purpose. Alternative F7 would define these old forest allocations through site-specific project level analyses. Alternatives having the most restrictive measures within old forests (e.g. S1) would probably result in the greatest protection for old forest conditions in the immediate future. However, as table S2 below shows, some alternatives (e.g. S2) would result in large reductions in wildfires, which may provide greater benefit in terms of the amount of old forest conditions available in the long run.

Potential Losses to Severe Wildfires

Over the last 30 years, wildfire in the Sierra Nevada has burned an average of about 43,000 acres per year. In the last ten years, the average has risen to about 63,000 acres per year. Table S2 below shows that reductions in the number of wildfire acreage burned each year are expected under all alternatives except F2 and F5.

Table S2. Comparison of Annual Wildfire Acreage among the Alternatives.

Variable	Alternative								
	S1	S2	F2	F3	F4	F5	F6	F7	F8
Annual acreage of wildfire, first decade	64,000	60,000	68,561	65,804	61,730	69,008	65,705	64,800	67,002
Annual acreage of wildfire, fifth decade	63,000	49,000	76,315	48,381	44,380	71,933	49,579	49,340	62,988
Percent change in annual wildfire acreage from first to fifth decade	-2%	-22%	10%	-36%	-39%	4%	-33%	-31%	-6%

Alternative F4 has the greatest reduction in acres expected to burn annually, followed in order by Alternatives F3, F6, F7 and S2

Old Forest Ecosystem Functions and Processes

Alternatives F5, F6, and F8 would place the greatest emphasis on prescribed burning, and consequently the greatest emphasis on reintroducing fire as a process in old forest ecosystems. Alternatives F5 and F8 would place more restrictions on prescribed burning than Alternative F6. Alternative F6, however, would establish explicit priority on restoring fire as a process in old forests, which would be different than provisions of any other alternative. Alternative F6 would result in the greatest restoration of fire as a process in old forests. Alternatives F4 and F7 would include low to moderate amounts of prescribed burning. However, treatment locations rely more on local discretion, so the extent to which these alternatives would restore fire to old forests is unknown. While Alternative F8 involves higher levels of prescribed burning, provisions in its standards and guidelines would limit the extent of this burning and therefore the amount of fire restoration in old forests. Alternative F2 entails very little prescribed burning and thus minimal restoration of fire to old forests.

Alternatives having the highest likelihood of connectivity between large blocks dedicated to old forests in order are Alternatives F2, F5, F3, F8, and F6. Alternative F4 would involve moderate-sized blocks dedicated to old forests, but the blocks would be widely distributed and therefore more limited in providing connectivity. Alternatives F3, F4, F5, F6, F7, and F8 would include provisions for maintaining old forest patches in the general forest, which would contribute to old-forest connectivity.

Alternatives S1 and S2 include the use of prescribed fire as a treatment method. Alternative S1 embodies a strong preference for the use of prescribed fire as the treatment method in several allocations, such as spotted owl and northern goshawk PACs outside of defense zones; however, limitations due to needs of smoke management and due to high existing fuel loadings may hamper some prescribed burn projects. Alternative S2 would allow more use of mechanical treatments as the initial treatment, with prescribed burning as the follow-up treatment, but requires use of prescribed burning as the initial treatment in PACs outside WUIs.

Aquatic, Riparian, and Meadow Ecosystems

The greatest effects on the Aquatic, Riparian and Meadow Ecosystems will generally be from either mechanical fuel treatments or catastrophic wildfires. The other potential effects from activities such as grazing, mining, pesticide use etc. will either affect only specific sections of the landscape such as meadows or their effects are constant across alternatives. When the balance between fuels treatment acres and risk of catastrophic wildfire is assessed, alternatives that lower the risk of fire and have medium levels of treatment pose the least risk to aquatic and riparian systems. This means that Alternatives F3, F6, S1, and S2 are expected to pose the least risk of negatively impacting riparian and aquatic ecosystems, Alternatives F4 and F7 an intermediate level; and Alternatives F2, F5, and F8 the highest.

Another consideration is the size of material removed and the retention requirements for forest stands. Erman and Erman (2000), found that large openings negatively affect the microclimate of the riparian zone. This means that alternatives that remove smaller material and require higher crown closures will have a greater benefit to the aquatic and riparian ecosystem. Using these criteria, Alternatives F2, F5, F8, S1 and S2 would have the least impact. However, the risk of catastrophic wildfire, which would have a profound effect on forest openings, is high in Alternatives F2 and F5. Thus Alternatives F8, S1 and S2 would have the least overall impact on long term forest structure surrounding riparian areas.

Other factors such as the requirement for landscape analysis, peer reviews, and special protection for sensitive species are components of alternatives that will provide increased protection for the aquatic and riparian ecosystems. Alternatives F3, F5, and S1 all require landscape assessment. These analyses will provide important context to management decisions and allow decisions to consider impacts to and needs of species outside of the immediate project area. The Conservation Assessments completed under Alternative S1 and S2 will inform management decisions in all aquatic and riparian habitats. It will provide some of the basic information needed to better manage habitats for these species. The creation of Critical Refuges in Alternative F5 and Critical Aquatic Refuges in Alternative F2, F6, F8, S1 and S2 will also provide special protection for sensitive species. The conservation assessments and refuges are important first steps in the development of conservation management strategies for aquatic and riparian dependent species.

Alternative S2 may pose higher short-term risks to aquatic resources because it prescribes larger amounts of mechanical treatments and greater treatment intensities. However, these are expected to reduce long-term effects associated with wildfire. Short-term risks associated with S2 will be greatly reduced through the application of the same Aquatic Management Strategy with similar standards and guidelines. Specifically, landscape and project-level analysis, attainment of RCOs, implementation of proven BMPs and other standards and guidelines, a modest reduction in overall road miles, and improved road conditions are the most important aspects of reducing risks to aquatic resources.

Based on all of the above factors, Alternative S1 best protects the values associated with aquatic and riparian habitats. Alternatives S2, F3 and F6 follow closely. The other alternatives have pluses and minuses in their ability to protect riparian and aquatic values. While Alternatives F4 and F7 reduce the risk of wildfire, they lack specific guidance that would provide protection to aquatic and riparian species. On the other hand, Alternatives F2, F5, and F8 provide protective management measures; they also pose the highest risk of catastrophic wildfire.

Fire and Fuels

Weather, topography and fuels influence the behavior of fires. All alternatives influence fires in the Sierra Nevada through a fire suppression program and modification of fuels and vegetation. The annual acreages of wildfire projected for each alternative are presented above in table S2. The greatest reduction in the annual acreage of wildfire within the first 5 decades would occur (in decreasing order) under Alternatives F4, F3, F6, F7, S2, F8, and S1. Alternatives F2 and F5 are projected to increase the acreage burned.

Modifying fuel loading across the landscape can effect changes on wildfire behavior by reducing fire intensities and rates of spread. This program also results in safer, more efficient fire suppression efforts. Table S3 below displays the acreage of fuel treatment (mechanical and prescribed burning) projected for each alternative. Alternatives that accomplish more acres of treatment should result in reduced wildfire severity as well as improved fire suppressions. The alternatives that are projected to modify fuel loadings and change fire behavior the most are F4, F7, F6, S2, and S1, in that order. Alternatives F3, F8, F5, and F2 involve treatments, but on smaller acreages. Note that the estimates in table S3 do not show the relative effectiveness of fuel modifications by alternative.

Table S3. Comparison of Extent of Mechanical and Prescribed Fire Fuels Treatments among the Alternatives.

	Alternatives								
	S1 _1/	S2	F2	F3	F4	F5	F6	F7	F8
Annual acreage of mechanical fuels treatment	51,345	72,200	7,022	30,081	86,168	9,858	33,381	70,045	13,867
Annual acreage of prescribed burns	49,560	42,020	15,457	53,582	46,760	39,356	82,747	60,113	69,038
Total acrege treated annually	100,905	114,220	22,479	83,663	132,928	49,214	116,128	130,158	82,905

_1/ acres based on gross treatment acres

Focal Species

California Spotted Owl

Under all alternatives the quantity and quality of useable habitat available for the California spotted owl is projected to increase across the species range. The alternatives are distinguished by differences in the amount of habitat and management of individual owl nest locations and home range areas. Alternative F4 is projected to produce slight declines in high quality habitat and would not protect all nest (and primary roost) stands. Among the remaining alternatives, Alternative F7 is projected to provide lower amount of useable habitat. Alternatives F2, F3, F5, F6, F8, S1 and S2 would protect all nest stands and have the highest projected increase in habitat values. These alternatives would provide positive benefits to California spotted owls, Alternative F2, F5 and F8 would limit activities within owl home ranges to a greater extent than would the other alternatives, and they could provide increased short-term protection. Improved understanding of relationships between owl habitat patterns at the home range scale and owl demographics, and application of this knowledge at smaller scales, would reduce the risks of implementing any of the alternatives. Alternative S2 has fewer restrictions on treatment methods and intensity within PACs and HRCAs than would Alternative S1.

Northern Goshawk

Alternatives F3, F5, F6, F8, S1 and S2 would provide the greatest contribution to maintaining and enhancing conditions for northern goshawk throughout the Sierra Nevada. These alternatives would protect all goshawk territories, and all are projected to increase amounts of high suitability habitat. Alternatives F4, F7, and S2 would provide less certainty about effects relative to the other alternatives because of the higher rates of mechanical treatments; however, they would provide greater protection from loss due to natural disturbance events.

Willow Flycatcher

The alternatives involve different approaches to managing and conserving willow flycatcher habitat and populations. Alternatives F2 and F8 would result in the greatest improvement in conditions for this species during the breeding season. Given the available data and uncertainties, Alternative F2, which excludes livestock grazing year-round in occupied willow flycatcher habitats, presents the greatest potential benefits to the species. Of all the action alternatives, Alternative F2 is the most likely to support long-term distribution and abundance of this species in Sierra Nevada national forests. Furthermore, Alternative F2 excludes grazing in meadow habitat within 5 miles of occupied sites, allowing for restoration and potential re-colonization of unoccupied sites and the opportunity for willow flycatcher population expansion and recovery.

Alternatives F3, F5, F6, S1 and S2 would provide slightly less improvement of conditions affecting the willow flycatcher than Alternatives F2 and F8. Alternatives F3 and F5 would provide more stringent guidelines than other Alternatives regarding general streambank use but weaker protections than Alternatives F2 and F8 specific to willow flycatcher habitat. Alternatives F3, F4, and F7 would provide an equal to slightly greater level of improved conditions associated with the willow flycatcher.

Alternatives S1 and S2 would apply the AMS and similar standards and guidelines for aquatic, riparian, and meadow ecosystems, to accomplish the same objectives. Alternative S2 involves slight differences relative to S1 where grazing surveys have not been completed, and it allows development of a site-specific management plan to address grazing management where occupied habitat exists. These alternative management strategies are locally determined and are designed to provide sufficient protection of this species.

Forest Carnivores

Four forest carnivores of special concern were identified: marten, fisher, wolverine, and Sierra Nevada red fox. The marten and fisher would more likely be directly affected by all alternatives than would the rarer wolverine and Sierra Nevada red fox, which are associated with higher elevations where relatively little management would take place. Consequences of the alternatives to these species were evaluated in terms of: (1) changes in vegetation structure and composition, (2) recreation and roads, and (3) survey requirements and site protection.

Fisher

Alternatives F5 and F8 would result the greatest improvements to fisher persistence and habitat. Both alternatives would provide fisher habitat through their provisions for retaining and recruiting large trees, snags, and coarse woody debris; retaining dense forest canopy; and promoting hardwoods on conifer sites.

Alternative F2 would provide habitat protections similar to Alternatives F5 and F8; however, because Alternative F2 relies primarily on fire suppression to manage the threat of severe wildfires, the risk of catastrophic fire would be higher under this alternative.

Alternative F3 would result in less benefit to fishers in terms of dead and down wood and hardwoods on conifer sites than either Alternative F5 or F8. Under Alternative F6, canopy closure in denning areas could be reduced to 40% in developed areas within urban WUIs.

All of the action alternatives would protect fisher den sites from human disturbance; however, none of the alternatives would reduce road-related risks to the same extent as Alternative F5. Alternative F5 would reduce potential recreation-related impacts in close proximity to fisher locations and would reduce the impacts of roads and related human disturbance by reducing road density and protecting unroaded areas.

Alternatives F4 and F7 would cause no change or slight increases in fisher habitat and population relative to the other alternatives. Alternative F4 could result in lower fisher abundance and distribution, as it would slightly decrease the availability of habitat elements important to fishers. Alternative F7 would reduce forest canopy from levels required for denning habitat to levels suitable for travel and foraging habitat, but would not change habitat conditions from the current situation.

Alternatives S1 and S2 are similar in projected amounts of fisher habitat over time, with differences primarily due to predicted change in habitat reduction from large wildfires. Under both alternatives a conservation assessment would be completed that could be used to develop a conservation strategy to improve management consistency across the species range. This assessment, coupled with ongoing research, should reduce the level of uncertainty regarding proposed treatments.

Marten

Environmental conditions important to marten and marten population would not be expected to change significantly from the current condition under any of the alternatives. All alternatives would result in retention and development of large trees at levels sufficient to protect and enhance marten habitat.

Under Alternatives F5, F6, F8, S1 and S2 new recreational developments would be evaluated for compatibility with marten needs when they were proposed in suitable marten habitat. In addition, Alternative F5 would reduce the impact of roads and related human disturbance by precluding roading of unroaded areas.

Alternative F2 provides direction for protecting marten habitat; however, this alternative would result in an increased risk of catastrophic fire, which could reduce habitat for this species. Compared to Alternatives F5 and F8, Alternative F3 would provide less dead and down wood and hardwoods on conifer sites.

Alternative F4 would only slightly decrease overall environmental conditions and predicted populations compared to the current condition. Alternative F4, S1 and S2 would reduce forest canopy cover in treated areas because it would establish and maintain both DFPZs and SPLATs. Alternatives F4 and F7 would provide less snag protection, which could lead to lower levels of recruitment of coarse woody debris over time. Alternative F4 has the highest level of fuels treatment and could result in less coarse woody debris recruitment. Alternative F7 emphasizes mechanical treatments over prescribed fire, possibly reducing coarse woody debris recruitment.

Sierra Nevada Red Fox

Although the current distribution of the Sierra Nevada red fox in California is uncertain, the species' range appears to have contracted from the continuous distribution described by Grinnell in the 1930s. Of all the alternatives, Alternative F5 would likely lead towards the greatest improvement in environmental conditions for and population of Sierra Nevada red fox, because it provides the greatest level of meadow protection, emphasizes reducing road densities across landscapes, and encourages new Sierra Nevada red fox surveys. Alternatives F3 and F5 would involve restrictions on recreational activities in unroaded areas. Alternatives F5, F6, and F8, would require detailed evaluation of recreational development on the basis of Sierra Nevada red fox detections and the presence of suitable habitat. Alternatives F6 and F8 would not require surveys, and these alternatives place fewer restrictions on recreation and roads. Alternatives F4 and F7 would provide more of the open forest habitat preferred by the Sierra Nevada red fox than would Alternative F5; however, Alternatives F4 and F7 would place fewer restrictions on recreation and would provide only moderate reductions in roads. Alternative F2 would prohibit off-highway vehicle and over-snow vehicle use in den site buffers. Alternative F2 would not require new surveys for the Sierra Nevada red fox.

Alternatives S1and S2 have similar effects on Sierra Nevada red fox. Alternative S2 clarifies direction to validate sightings of this species by a forest carnivore specialist and clarifies the implementation of a limited operating period to better ensure that it is applied when warranted to reduce the potential to disturb breeding individuals.

Wolverine

Consequences to wolverines are primarily influenced by: (1) recreation and roads and (2) survey requirements and site protection. Based on the combined categories, Alternatives F5, F8, S1, S2 would likely result in the greatest benefit to wolverine persistence and recovery. Alternatives F5 and F3 would restrict recreational activities in unroaded areas. Alternative F5, F6, and F8 would require evaluation of recreational development on the basis of wolverine detections and the presence of suitable habitat. Alternative F5 would emphasize reducing road densities and would encourage new surveys. Alternative F3, S1 and S2 would not provide the same level of benefits as Alternatives F5 and F8 because it would not require surveys, however it would limit activities around locations of verified wolverine sightings.

All Alternatives would increase the extent of suitable wolverine habitat from the current condition, with increases ranging from 5.4 to 9.1%. Alternatives F4 and F7 would result in only slight increases. However, these increases are not significant because none of the alternatives substantially affect the vegetation associated with wolverine habitat, either as interpreted from the standards and guidelines or from habitat utility values projected by the CWHR model. Alternatives F4 and F7 would not encourage surveys, and they would have greater potential for new road development than the other alternatives.

Alternative F2 would pose more risks related to the effects of roads and survey requirements than Alternative F5, but would generally provide greater benefits to wolverines than Alternatives F4 and F7.

As with the Sierra Nevada red fox, Alternatives S1 and S2 would have similar effects on this species. Alternative S2 applies the same clarification regarding verification of sightings by a forest carnivore specialist and implementation of a limited operating period as described for the Sierra Nevada red fox.

Amphibians

Foothill Yellow-Legged Frog

Alternatives F2 and F5 appear to provide the greatest level of protection to the foothill yellow-legged frog, because they provide the most effective management approaches for this species' persistence and recovery. Alternatives F3, F6, F7, and F8 would provide a slight improvement from the current condition. Alternative F4 would decrease environmental conditions compared with the current condition. Information and research gaps, especially regarding the impacts of livestock utilization standards for grass and shrubs on the foothill yellow-legged frog, add uncertainty to this assessment.

Alternatives S1 and S2 apply the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. These alternatives protect discovered populations by designating critical aquatic refuges (CARs).

Mountain Yellow-Legged Frog

Alternatives F3, F5, F8, S1 and S2 would likely result in the greatest improvements in populations of mountain yellow-legged frog, because they provide the most effective management approaches for this species' persistence and recovery. Alternatives F4, F6, and F7 would result in less improvement in population numbers.

Alternatives S1 and S2 incorporate the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. These alternatives protect discovered populations by designating CARs. Some mountain yellow-legged frog populations may exist within habitat for the Yosemite toad, willow flycatcher, or great gray owl. Alternative S2 changes some of the grazing management standards and guidelines related to these species, which could potentially indirectly affect the mountain yellow-legged frog. However, changes in grazing management would require site-specific analyses, including biological evaluations that would address all species occurring within the affected area. Thus, the implications of such changes would likely be minimal.

The U.S. Fish and Wildlife Service has determined that a listing of this species under the federal Endangered Species Act (ESA) as *threatened* is warranted, but action towards listing is currently precluded due to other priorities. If this species is formally listed in the future, changes in management direction may be warranted.

Yosemite Toad

Alternative F8 would result in the greatest improvement of environmental conditions for the Yosemite toad, because it would provide the most effective management approach for this species' persistence and recovery. Alternatives S1 and S2 will most likely have similar results to F8, but have increased risk associated with some potential for late season grazing effects. Alternatives F2, F3, and F5 would result in slightly less improvement, because of lack of specific direction limiting livestock grazing where the species is present. Alternative F2 includes provisions for establishing an amphibian reserve system to protect known occupied and suitable unoccupied amphibian habitats (FEIS Appendix D, standard and guideline AM12). Alternatives F3 and F5 would protect, known, occupied amphibian habitats. These are based on records over the last 25 years (FEIS Appendix D standard and guideline AM13). Alternative F4 would provide for improvement from the current condition.

Alternatives S1and S2 applies the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. These alternatives protect discovered populations by designating CARs. Alternative S2 changes some of the grazing management standards and guidelines related to the Yosemite toad. It allows use of alternative management strategies that are locally determined to provide sufficient protections for this species. Although the intent of these alternative management strategies is to provide for and protect habitat for the species, some difficulties in implementation may increase the risk of success in avoiding impacts to Yosemite toads. Some of these risks would arise with Alternative S1 as well and are due to the difficulty in managing livestock in the forest environment.

The U.S. Fish and Wildlife Service determined that a listing of this species under the ESA as *threatened* is warranted, but action towards listing is currently precluded due to other priorities. If this species is formally listed in the future, changes in management direction may be warranted.

Cascades Frog and Northern Leopard Frog

Alternatives F5, F8, S1 and S2 would likely result in the greatest improvement of conditions for the Cascades frog and northern leopard frog, because they provide the most effective management approaches for this species' persistence and recovery.

Alternatives S1 and S2 apply the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. Under these alternatives, populations would be protected as they are discovered by designating CARs. Some populations of these species may exist within habitat for the Yosemite toad, willow flycatcher, or great gray owl. Alternative S2 involves changes to some of the grazing management standards and guidelines related to these other species, which could potentially indirectly affect these frog species. However, changes in grazing management would require site-specific analyses including biological evaluations that would address all species occurring within the affected area. Thus, the implications of such change would likely be minimal.

Socio-Economic Concerns

Economy

National forest management directly affects the socioeconomic environment of the Sierra Nevada through employment and income derived from resource extraction, production, and use. Timber harvest from national forest lands provides a flow of products to area industries.

Alternatives F4, F7, and S2 would provide the largest number of jobs annually in the commercial logging sectors. Consequently, these alternatives would also result in the highest estimated annual earnings in these economic sectors. (Table S4)

Table S4. Comparison of Estimated Average Annual Employment and Earnings from Commercial Timber Harvests on National Forests among the Alternatives in the First Decade.

	Alternative								
	S1	**S2**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
Estimated average annual jobs	957	1,894	145	566	3,467	322	526	2,730	222
Estimated average annual earnings (thousands $, 1995)	38,344	57,159	7,458	26,099	116,023	14,345	26,136	89,913	12,212

Commercial Forest Products

Table S5 displays the modeled annual yield of green and salvage harvests by alternative for the first two decades. These estimates include the timber volumes produced under the HFQLG pilot project. The amount of salvage volume projected for each alternative is well less than the amount of annual mortality (700 million board feet [MMBF]) estimated for these forests in the SNFPA FEIS (volume 2, page 380).

Six of the alternatives would produce volumes exceeding 100 MMBF annually. In decreasing order of volume production, these alternatives are F4, F7, S2, F6, F3 and S1. The remaining Alternatives (F5, F8, and F2) would produce less than 100 MMBF annually. For comparison, the average amount of timber offered during the six years following adoption of the California spotted owl guidelines (CASPO guidelines) (1994-1999) was 372 MMBF per year.

The amount of green volume offered in the second decade is less than in the first for each alternative. Maintenance of previously treated areas will be a significant part of the annual program of work, which will result in less volume offered.

Table S5. Comparison of Estimated Annual Timber Harvest Volume (Green and Salvage) Offered for Sale from National Forests among the Alternatives (MMBF/yr).

	Alternative								
	S1	S2	F2	F3	F4	F5	F6	F7	F8
First Decade									
Salvage timber	30	90	17	33	238	29	91	142	42
Green timber	70	329	22	84	534	49	80	414	33
Total timber	100	419	39	117	722	78	171	556	75
Second Decade									
Salvage timber	30	90	17	33	238	29	91	142	42
Green timber	20	132	7	21	294	7	57	210	14
Total timber	50	122	24	54	522	36	148	352	56

Table S6 summarizes the estimated commercial biomass output that could be available for sale under each alternative by decade. Alternative S2 is projected to produce the largest amount of commercial biomass, followed by Alternatives F7, F4, and S1. The other alternatives would produce between 9% (Alternative F2) and 41% (Alternative F6) of the amount of biomass produced by Alternative S2.

Table S6. Comparison among the Alternatives of Potential Commercial Biomass Output from National Forests in the First Decade (1,000s of bone dry tons).

Alternative								
S1	S2	F2	F3	F4	F5	F6	F7	F8
4,385	7,021	660	2,440	6,200	1,710	2,910	6,680	1,720

Grazing

All alternatives would reduce the current numbers of livestock permitted to graze on national forest lands because total forage (as measured by animal-unit months) offered by the national forests would decline (table S7). Alternatives F4 and F7 would have more suitable rangeland (acreage available for grazing) than the other seven alternatives.

Table S7. Comparison among the Alternatives of Reduction in Animal-Unit Months Offered by National Forests.

Alt S1	Alt S2	Alt F2	Alt F3	Alt F4	Alt F5	Alt F6	Alt F7	Alt F8
83,000	83,000	140,000	69,000	56,000	172,000	72,000	56,000	110,000

Alternatives F2, F5 and F8 would establish more conservative standards and guidelines related to grazing activities than would the other alternatives. These standards and guidelines would remain in effect on a particular range until a range analysis could be completed to determine the range condition. In many cases, these conservative standards would make it uneconomical for permittees to graze their allotments while waiting for an analysis to be completed. Because many years would be required to complete analyses of several hundred allotments on the Sierra Nevada national forests, many permittees would probably give up their permits.

Alternatives F4 and F7 would cause the least reduction in grazing use. F2, F5, and F8 would cause the greatest reductions in grazing use. The intermediate alternatives in order of least to greatest reduction in grazing are F3, F6, and S2/S1.

Alternatives S1 and S2 were further evaluated by estimating effects on allotment permittees. By employing alternative strategies to protect wildlife species, Alternative S2 is estimated to eliminate the grazing deferral described above for 14 allotment permittees, whereas Alternative S1 would require grazing deferral by these 14 allotment permittees. Seven permittees would be very highly impacted by both Alternatives S1 and S2. (Table S8).

Table S8. Comparison of Effects to Permittees between Alternatives S1 and S2.

	Alt S1	Alt S2
Number of permittees slightly affected	11	7
Numbers of permittees moderately affected	17	10
Number of permittees highly affected	12	9
Number of permittees very highly affected	7	7

Roads

The forest development road arterial system would remain in its current location in Alternatives F2-F8 and S1. No arterial roads would be decommissioned. Improving arterial roads would continue to be a priority for road construction funding.

The forest development road collector system would also remain in its current location in these alternatives. Construction or decommissioning of collector roads would be unlikely. Collector roads would be improved and managed to provide a more stable road surface, primarily using gravel and dust abatement.

The most substantial changes in the forest development road system would be changes in the mileage and conditions of local roads. Some roads would be improved to reduce impacts on adjacent resources, but typically local roads have lowest maintenance priority. Some local roads may become undriveable due to vegetative encroachment. The mileage of local roads would decrease, because some local roads would be decommissioned.

The mileage of unclassified roads would also decrease. Unclassified roads would be evaluated as they were encountered during planning of vegetation treatments. Some unclassified roads (e.g. those supporting unauthorized uses) would be decommissioned. Others providing needed access would be improved and added to the forest development road system. In some areas the size of the forest development road system would increase as needed roads were added to it. If these roads were supporting authorized uses, adding them to the forest development road system would not affect existing public access.

Alternative S2 would result in different effects on the roads system than the other alternatives. Alternative S2 would allow construction, maintenance, and decommissioning of roads in support of full implementation of the HFQLG pilot project. This will result in an increase in the mileages of the forest development collector system and local road system, along with decommissioning other roads.

Air Quality

Emissions of particulate matter larger than 10 microns (PM_{10}) would be expected to differ by alternative in proportion to the acreages of wildfire and prescribed burning that would occur. Total emissions are expected to increase over time for Alternatives F2 and F5, given the projected increase in wildfire acres. All other alternatives (S1, S2, F3, F4, F6, F7, F8) should result in a reduction in total emissions, simply as a result of wildfire reduction.

Table S9 displays annual emissions of PM_{10}, based on acreages of wildfire and prescribed burning projected for each alternative. Comparison of all alternatives shows 43% difference in annual emissions between the lowest emitting (S2) and highest emitting (F6) alternative. Although Alternatives S2 and S1 would involve larger acreages of prescribed burning than under Alternative F2 (Table S3), Alternative S2 would result in the lowest total PM_{10} of all of the alternatives. This result is due primarily to the relatively small acreage burned by wildfire under this alternative and because mechanical treatments would be used extensively to reduce fuel loadings prior to prescribed burning. Alternative S1 would result in the next lowest total PM_{10} emissions.

Mechanical fuels treatments can reduce the amount of particulate from wildfires and from prescribed burns. As shown in Table S3, Alternatives F4, S2, S1, and F7 include the largest amount of annual mechanical fuel treatments. Over time (decades), particulate emissions from wildfires as well as prescribed burning on treated areas should diminish.

Timing of prescribed burns helps reduce particulate emissions during periods of critical air quality. Because all projects are to be designed to keep smoke emissions from causing violations of ambient air quality standards, all alternatives are consistent with provisions of the Clean Air Act.

Table S9. Comparison of Particulate Emissions among the Alternatives in the First Decade (tons of PM_{10}).

	Alternative								
	S1	**S2**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
Annual wildfire emissions	23,700	22,600	25,300	24,300	22,800	25,500	24,200	24,000	24,700
Annual prescribed fire emissions	2,000	2.400	3,500	12,600	11,900	9,200	18,100	13,900	14,500
Total annual emissions	**25,700**	**25,000**	**28,800**	**36,900**	**34,700**	**34,700**	**42,300**	**37,900**	**39,200**

Recreation

In general, all of the alternatives could have localized effects on certain types of recreation activities on national forest lands. Alternatives F2, F3, F5, F6 and F8 would cause a slight reduction in the number of recreation visitor days (RVDs). These alternatives would favor a trend toward more dispersed, non-motorized recreation, such as hiking and backcountry camping. Alternatives F4 and F7 would maintain the current level of RVDs.

Alternatives S1 and S2 would have similar effects on recreation. Alternative S2 clarifies direction contained in Alternative S1 to explicitly apply limited operating periods for protection of various wildlife species to vegetation treatments and not to recreation related activities. However, new recreation activities still require analysis under NEPA, and recommendations for limited operating periods could be adopted as deemed necessary at the project level. Alternative S1 includes direction that may limit recreational pack stock activities in meadows containing or potentially containing willow flycatchers and/or Yosemite toads.

Chapter 1: Purpose and Need

Table of Contents

Chapter 1: Purpose and Need

1.1. Introduction

This supplemental environmental impact statement (SEIS) addresses three problem areas in the Sierra Nevada region that were analyzed in the Final Environmental Impact Statement (FEIS) for the Sierra Nevada Forest Plan Amendment (SNFPA) (USDA Forest Service, Pacific Southwest Region 2001a):

- old forest ecosystems and associated species
- aquatic, riparian, and meadow ecosystems
- fire and fuels

New understanding has been gained and new information has become available since the SNFPA Record of Decision (ROD) was adopted for the forests of the Sierra Nevada (USDA Forest Service, Pacific Southwest Region 2001b).

Several alternative management approaches are described in chapter 2, including a “no action” alternative that would continue the management direction established by the ROD in January 2001. The other alternatives include the alternatives originally considered in the FEIS and one new alternative—the proposed action and preferred alternative, which was formulated to respond to findings of a SNFPA review team, as described in the following section. Chapter 3 describes the affected environment updated since the FEIS was completed. The environmental consequences of each management alternative are documented in chapter 4. Appendices describe standards and guidelines for implementation of the no-action alternative and the proposed action, modeling assumptions and techniques, and assess the applicability of the FEIS effects analysis to the new alternatives assessed in chapter 4. A companion volume includes public comments on the draft SEIS, together with the Forest Service’s response. A list of acronyms and abbreviations, list of references cited in the document, an index, and a list of preparers for the SEIS are found at the back of this document.

This document is the *final* version of the SEIS, prepared pursuant to the National Environmental Policy Act. The *draft* SEIS was released to the public in June 2003. A comment period of 90 days was established, and over 55,000 comment messages were received. In response to these public comments and the outcome of reviews by Forest Service land and resource managers, the alternatives in the draft SEIS were modified, factual corrections were made, and the supporting analysis was modified and improved.

This SEIS describes proposed amendments and discloses effects of those amendments to the land and resource management plans for the Modoc, Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sequoia, Sierra, Inyo, and Humboldt-Toiyabe National Forests and the Lake Tahoe Basin Management Unit. Current management direction applicable to portions of the Lassen and Modoc National Forests as amended by the Northwest Forest Plan are not affected by changes proposed in this SEIS.

1.2. Background

Completed in January 2001, the SNFPA FEIS and ROD were the product of more than 10 years of regional planning efforts for management of the species and ecosystems of the Sierra Nevada bioregion. The Forest Service received more than 200 appeals of the decision. The Chief of the Forest Service (Chief) affirmed the decision but directed the Regional Forester of the Pacific Southwest Region (Regional Forester) to review certain elements of the decision.

In December 2001, the Undersecretary of Agriculture for Natural Resources and Environment (Undersecretary) returned the SNFPA decision to the Forest Service, electing not to conduct a discretionary review. The Undersecretary expressed confidence that the Regional Forester would develop an aggressive plan to respond to the Chief's appeal decision with an open, public review of SNFPA.

The Regional Forester chartered the SNFPA Review Team (Team) to evaluate the SNFPA ROD and recommend any needed changes in six specific areas. The Regional Forester directed the Team to use an open public process to identify opportunities to

- pursue more aggressive fuels treatments while still protecting old-forest conditions and species at risk,
- improve compatibility with the National Fire Plan to ensure that goals of community protection and forest health are accomplished,
- implement the Herger-Feinstein Quincy Library Group Pilot Project to the fullest extent possible,
- reduce unintended and adverse impacts on grazing permit holders,
- reduce unintended and adverse impacts on recreation users and permit holders, and
- reduce unintended and adverse impacts on local communities.

The Team reviewed the SNFPA ROD and FEIS and supporting documents and gathered information concerning each of the above areas. The Team gathered input from national forests currently implementing SNFPA and former members of the SNFPA interdisciplinary team, held meetings with interest groups, sponsored field trips, and reviewed work products generated by the Regional Office SNFPA Implementation Team. The Team also reviewed the appeals record and the Chief's appeal decision.

The Team investigated a number of concerns related to the subject areas identified by the Chief and Regional Forester. During the review, new analytical techniques were developed to provide insight into how management direction was implemented on the ground. Some additional information was collected and compiled concerning species of concern from new research, conservation assessments, and field surveys. While the review was underway, the U.S. Fish and Wildlife Service (FWS) released listing decisions for the California spotted owl and Yosemite toad. The findings of the year-long review are acknowledged in this SEIS. The review is documented in Sierra Nevada Forest Plan Amendment, Management Review and Recommendations (USDA Forest Service Pacific Southwest Region 2003g), which is hereby incorporated by reference.

1.3. Purpose and Need for Action

The purpose of the proposed action is to adjust existing management direction to better achieve the goals of SNFPA. The SNFPA Review described above, as well as insight gained from almost three years of implementing SNFPA, highlighted the need for refinements of management direction in the following three broad problem areas originally identified in SNFPA: old forest ecosystems and associated species; aquatic, riparian, and meadow ecosystems; and fire and fuels. It also highlighted the need to refine management direction so as to implement the *Herger-Feinstein Quincy Library Group Forest Recovery Act* to the fullest extent that is compatible with other legal mandates.

1.3.1. Old Forest Ecosystems and Associated Species

The Sierra Nevada Ecosystem Project (SNEP) report (chartered by Congress and completed in 1996) found that old forest ecosystems were one of the most altered ecosystems in the Sierra Nevada Region and that the habitat and/or population of some animals associated with old forests was in decline. Accordingly, SNFPA was intended to provide regionally consistent direction for old forest conservation. Specific goals included in the FEIS (volume 1, chapter 1, pages 5-6) were to:

- protect, increase, and perpetuate desired conditions of old forest ecosystems, and conserve their associated species, while meeting people's needs for commodities and outdoor recreation;
- increase the density of large trees, increase structural diversity of vegetation, and improve the continuity and distribution of old forests across the landscape; and
- reverse declining trends in the abundance of old forest ecosystems and habitats for species that use old forests.

The above needs are still valid and must be addressed when making changes to existing management direction. However, the new information concerning species dependent on old forest ecosystems requires consideration. For example, recent analysis of California spotted owl populations in four study areas within the Sierra Nevada can better inform judgments about the current population status and risks of actions to reduce hazardous fuels.

After reviewing the best available scientific and commercial information available, in February 2003 FWS announced that listing of the California spotted owl as an endangered species was not warranted. In that finding, the use and availability of owl habitat on private lands was documented (see chapter 3 for a summary of that info). The finding also assumed that management of the national forests in the Sierra Nevada was based on the SNFPA. The finding and the rationale for it are also important pieces of information acknowledged in the SEIS.

California continues to have significant problems with wildland fire and forest health. Decades of fire exclusion have produced overcrowded vegetation in many forests, which has weakened trees and made them more fire prone and more susceptible to pests, diseases, and displacement by invasive species. The number and severity of wildfires continues to increase. Using historic fire data and recent trends, habitat losses are expected to increase on the average. More importantly, these losses are likely to result from significant fire events that cause significant impacts to habitat in a concentrated location instead of averaged over the bioregion. There is a need to reduce expected habitat losses to a rate at least equal to replacement by treating enough acres with enough intensity to significantly modify fire behavior. The SNFPA Review indicated that adjustments to management direction would improve the Forest Service's ability to accomplish this goal.

1.3.2. Aquatic, Riparian, and Meadow Ecosystems

SNEP found that aquatic, riparian, and meadow ecosystems are the most degraded of all habitats in the Sierra Nevada, although much of this problem was seen to be related to lower elevation dams and diversions. In addition, many aquatic and riparian-dependent species, such as willow flycatcher and Yosemite toad, were found to be at risk of extirpation. SNFPA was intended to provide regionally consistent direction to address these problems. Specific goals were to

- protect and restore desired conditions of aquatic, riparian, and meadow ecosystems in Sierra Nevada national forests; and
- provide for the viability of species associated with those ecosystems.

The above needs are still valid and must be addressed when making changes to existing management direction. However, new information must be considered concerning the population status and distribution of Yosemite toad and willow flycatcher, which was gained from two years of field surveys conducted according to established protocol. The recently completed conservation assessment for the willow flycatcher includes updated information about the status of the species and possible refinements to management and restoration of suitable habitat. This information reinforces the importance of considering local data and conditions when planning projects in flycatcher habitat.

An assessment of the reduction in grazing activity that would result from implementing FEIS standards and guidelines for meadows and meadow-associated areas was completed during the SNFPA Review. Accordingly, the SEIS considers changes to management direction that would require the development of site-specific grazing strategies, to allow more economic benefits to be retained while continuing to minimize risks to sensitive species.

1.3.3. Fire and Fuels

The SNFPA FEIS recognized that wildland fire poses a major threat to life, property, financial resources, and natural resources in the Sierra Nevada. In addition, the continued and rapid growth of the region's human population continues to increase the risk of loss of life and property from wildfires, unless hazards are mitigated. The SNFPA was intended to provide a coordinated strategy for addressing the risk of catastrophic wildfire that resulted from decades of fire suppression and the resulting build-up of hazardous fuels. Specific goals were to

- reduce the wildfire threat to human communities and ecosystems and natural resources,
- maintain ecosystem functions, and
- decrease the cost of fire suppression.

These goals remain valid and must be addressed when making changes to existing management direction. However, since the ROD was signed, changed circumstances must be considered in framing management direction to attain these objectives.

The National Fire Plan represents a collaborative approach to wildland fire management that has broad support from the Administration, Congress, the Western Governors, and many other local and regional groups. In May of 2002, the Secretaries of Agriculture and Interior and the Western Governors developed an implementation plan for this collaborative effort. It encourages local Forest Service units to work collaboratively with state and local agencies to accomplish the desired outcomes of this plan. The Regional Forester is committed to achieving the goals of the National Fire Plan and wants management direction for the Sierra Nevada forests to contribute to achieving the goals and meeting the performance measures of the implementation plan.

The SNFPA Review identified aspects of the existing management direction that must be refined to achieve this goal. Stated briefly, fuels treatments must significantly lower wildfire intensity and rate of spread, thus directly contributing to more effective suppression and smaller acreage burned. Hazardous fuels must be treated in a cost-efficient manner to maximize program effectiveness. Fuels management must actively restore fire-adapted ecosystems by making demonstrable progress in reducing the acreage of unnaturally dense forest (i.e. changing a substantial acreage from Fuel Condition Class 2 or 3 to Condition Class 1).

The SNFPA Review also recognized that the by-products of mechanical thinning present an economic opportunity for local communities. The Review identified measures to assess the degree to which fuels reduction programs are creating local economic benefits. Increasing the economic value of fuel treatment byproducts would also improve the Forest Service's ability to treat the desired acreage of hazardous fuels with available appropriated dollars.

The SNFPA Review Team identified a need to more fully consider three critical aspects of the fire and fuels management strategy established in SNFPA. Selected standards and guidelines need to be adjusted to ensure that certain post-treatment conditions can be met. In particular, fuels treatments must

- be strategically placed across the landscape,
- remove enough material to cause wildfires to burn at lower intensities and slower rates of spread in treatment areas compared to untreated areas, and
- be cost-efficient, so program goals can be accomplished with available appropriated dollars.

The Review Team's analysis identified the prescriptive nature of the existing standards and guidelines for vegetation management to be a primary barrier to meeting these three needs. This potential problem was recognized in the FEIS by a statement concluding that "Modified Alternative 8 would have stand level structural requirements that could preclude full implementation of the fuels strategy" (FEIS volume 1, "Summary," page 29).

The SNFPA Review identified the need to adjust the existing fuels management direction to make it less complicated and costly to implement. To meet that need, standards and guidelines must allow a wider array of tools and techniques for meeting fuels reduction objectives that better respond to local resource conditions in a cost-effective manner. In addition, the FEIS's emphasis on prescribed burning for initial treatments needs to be reduced because of public concerns about smoke and because of the limited number of permissible burn days under state air quality management rules.

1.3.4. Implementation of the Herger-Feinstein Quincy Library Group (HFQLG) Forest Recovery Act Pilot Project

Within the Sierra Nevada bioregion, a number of special plans and projects are underway to test alternative management strategies. Some of these were explicitly recognized in the ROD and were allowed to continue unimpeded by new direction in SNFPA. These initiatives include the Upper Pit River Watershed Restoration Project, the Hackamore Ecosystem Restoration Project, the Warner Mountain Rangeland Management Planning Effort, the Modoc/BLM Experimental Stewardship Project, management of the Big Valley Sustained Yield Unit, and management of the Sequoia National Monument. However, the ROD did not make provisions for the HFQLG Pilot Project to continue in its original form. Instead, the ROD imposed new land allocations, new standards and guidelines for sensitive species, and a new fire and fuels strategy, and it eliminated the project's program of group selection (except as part of an administrative study). Under the SNFPA ROD, the rate of implementation of DFPZs was approximately 40% per year of what was envisioned by the Act and approximately 12% per year for group selections.

The pilot project was intended to produce information needed to reduce scientific uncertainty concerning environmental effects of certain forest management activities. However, the SNFPA Review found that, collectively, the standards and guidelines in the ROD limited this learning from occurring and, therefore, compromised the adaptive management strategy. In addition, the Review Team found that HFQLG's goal of commodity production was also compromised by the ROD, which made no provision for regeneration harvest to continue within or outside of the HFQLG pilot project area. In light of these findings, management direction needs adjustment to better reconcile the goals of the HFQLG Pilot Project with those of the SNFPA and its adaptive management component.

1.4. Proposed Action

The decision to be made is whether to amend as described above the land and resource management plans for the Humboldt-Toiyabe, Modoc, Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, Sequoia, and Inyo National Forests and the Lake Tahoe Basin Management Unit.

The proposed action responds to changed circumstances and information identified in a year-long review of SNFPA. The following is a general overview of the proposed action. It is described in more detail as *Alternative S2* in chapter 2.

The proposed action replaces the standards and guidelines of the existing SNFPA strategy for fire and fuels with direction that provides flexibility needed at the local level to effectively modify wildland fire behavior. Opportunities are also provided to allow for generation of by-products. By-product production would offset the cost of fuels treatment and allow the desired program level acreage of hazardous fuels to be treated. In addition, the basic fire and fuels strategy provides for other important objectives, such as reducing tree stand density to improve forest health, restoring and maintaining ecosystem structure and composition, and restoring ecosystems after severe wildfires and other large catastrophic events. The resulting integrated strategy is designed to be aggressive enough to minimize risks to communities from wildfire in the urban-wildland interface and to adequately address the threats to wildlife of catastrophic wildfires across broader landscapes. This strategy must be balanced with the need to ensure that wildlife and other resource values are protected today and in the future.

The proposed action also provides for implementation of the HFQLG Forest Recovery Act Pilot Project.

The proposed action includes new standards and guidelines for willow flycatcher habitat, Yosemite toad habitat, great gray owl protected activity centers, as well as grazing utilization standards to better reflect the wide array of site-specific conditions and the management opportunities they may provide.

The proposed action clarifies management intent for off-highway vehicles; applies the requirement for limited operating periods only to vegetation management activities; and clarifies applicability of several riparian standards and guidelines to recreation activities, uses, and projects. These changes are proposed to more closely align management direction with management goals established in SNFPA.

1.5. Responsible Officials and Decision to be made

The Regional Foresters for the Pacific Southwest Region and the Intermountain Region are the responsible officials for amendment of the SNPFA. The Chief has delegated signing authority for the Intermountain Regional Forester to the Regional Forester for the Pacific Southwest Region.

1.6. Public Participation

From early June through August extensive outreach efforts were made by national forest leaders to highlight management proposals and encourage public participation for the development of a selected alternative.

Each forest supervisor strongly attempted to engage the local communities through a variety of programs and comment opportunities during the public comment period. The majority of those contacted were interested in the proposals and clearly some groups expressed high interest in the proposed management actions.

Each national forest worked with the general public, elected officials, Resource Advisory Councils (RAC's), Native Americans, special interest groups, the media, and other people in their local area.

Supervisors and their staff's hosted field trips, attended and presented programs to special interest or local groups, submitted opinion editorials, provided written material or audio visual programs, talked with the media, and discussed with a wide variety of interests the proposals for future management. In addition, a web site was available for further information on management proposals.

Citizen participation varied and ranged from minimal at some public meetings, to greater participation at special interest group presentations, or at specific events. The Stanislaus National Forest, for example, met with range permittees at a well attended meeting to discuss procedures for permittee compliance.

USFS employees also were briefed or requested to monitor the development of the Draft SEIS to more adequately discuss the project with the public or participate in its development.

Collaborative interest continued to be a theme with presentations. For example, the Eldorado National Forest in mid-August discussed the SEIS in a public collaborative learning meeting to prioritize fuels reduction work.

Highlighting fuels management was a topic of frequent discussions and field trips. At one national forest, congressional aides visited field sites to review the issues and view some of the problem areas.

Although many meeting participants were familiar with the issues, there were indications that some lacked an awareness of current management, particularly in the area of fuels reduction. This was noted by the Tahoe National Forest staff that subsequently developed a field trip to show fuels reduction completed in a Wildland Urban Interface site.

The intent of the public involvement program was to inform people of the opportunity to review the Draft SEIS and to comment on it. The activities focused on explaining the need for action to improve accomplishments of Framework goals, National Fire Plan, HFGLG Pilot Projects, and means to reduce impacts of recreation and grazing activities. The public involvement activities explained the proposed changes and compared them to the current SNFPA rules, especially as they accomplished habitat protection and reduced wildfire losses.

A sample of the methods used by each national forest for public involvement includes the following:

- Elected officials – letters to, or meetings (including field trips) with, federal, state, or county government leaders
- Public meetings – open house, collaborative, or formal meetings
- Special interest groups – group meetings, field trips, presentations, individual leadership meetings
- Fire Safe Councils – presentations to council or key leaders
- Service Clubs – presentations
- Media – opinion editorials, electronic media interviews, reporter briefings, accompaniment on field trips, news releases
- Native Americans – presentations to tribal leaders, letters of notification on public comment periods
- Employees – letters or briefings
- Federal/State/County/City Agency – letters or briefings

Public Comment

The Draft SEIS was available for public review and comment from June 13, 2003, to September 12, 2003. During the comment period, the Forest Service heard from nearly 56,000 people. The agency received approximately 1,300 individual letters, 3 resolutions, and approximately 600 different form letters. Organized response campaigns accounted for 97.5 percent of the total pieces of mail (53,866 form letters out of a total of 55,258) received during the public comment period. These response campaigns generally fell into one of two categories: forms or multi-signature letter (numerous signatures on one letter). Over 400 public concerns were identified from the comments.

Public concerns reflected a broad range of views relative to the proposed action and analysis of alternatives presented in the Draft SEIS. Numerous concerns were raised about the purpose and need for the proposed amendment and many questioned the agency's decision to propose an amendment. The Forest Service received a wide variety of comments regarding the adequacy of the environmental analysis presented in the Draft SEIS. Generally, the public expressed a desire to see more information in the Final Supplemental Environmental Impact Statement, such as information regarding impacts to recreation, grazing, timber production, cultural resources, and socio-economics.

Many comments expressed concerns that the Draft SEIS did not adequately address impacts to at-risk Sierra Nevada wildlife species, including the California spotted owl, fisher, marten, willow flycatcher, and amphibians, such as the mountain yellow-legged frog and the Yosemite toad. Changes in grazing restrictions and projected increases in mechanical harvesting under the preferred alternative raised concerns about potential fragmentation of important habitats for these species and possible adverse impacts. Concerns were raised that the proposed amendment could undermine the Forest Service's mandate under the National Forest Management Act to maintain viable populations of designated sensitive species. Others asserted that improving forest health should not be overridden by wildlife habitat objectives, and requested the Forest Service to craft an amendment that provides for maximum flexibility in carrying out fuels reduction and forest health projects.

The public expressed a broad range of concerns relative to fire and fuels management. Goals for protecting communities from wildfire and for preserving species and ecosystems were often viewed as conflicting. Public comments regarding fire and fuels management reflected this conflict with comments that were often polarized in a "protect people" versus a "protect the environment" stance. Broad themes in public concerns relative to fire and fuels management included: a need to harmonize planning efforts with national direction, a need to clarify and justify information presented in the SEIS, a need to ensure funding for fire and fuels management, and a need to better define where treatments will occur and what techniques will be used for fire and fuels treatments.

1.7. Forest Service and Tribal Relations

The relationships of the Forest Service with American Indian tribal governments, communities, and organizations are important in the management and restoration of ecosystems in the Sierra Nevada and Modoc Plateau. Tribal representatives participated in the Sierra Nevada Framework Management Review and Supplemental EIS process through interagency team meetings, workshops, field trips, and presentations. The Forest Service continues to work with tribal governments through forest level government-to-government consultation to seek increased opportunities to implement the nine commitments of the SNFPA that were included in the Record of Decision (pages 52-3). At the regional level, annual Sierra Nevada tribal summits are co-hosted, on a rotating basis, by local tribes and forests. At these tribal summits, relationships and communication networks are strengthened through local examples of SNFPA commitment accomplishments and updates of works-in-progress.

To meet our responsibilities under the trust relationship, to encourage the participation of American Indians in national forest management, and to build on the progress made to date, the forests will continue to honor the Record of Decision commitments:

- We will work with tribal governments and tribal communities to develop mutually acceptable protocols for government-to-government and tribal community consultations. These protocols will emphasize line officers' and tribal officials' roles and responsibilities.

- We will consult with appropriate tribal governments and tribal communities regarding fire protection and fuels management activities that potentially affect rancherias, reservations, and other occupied areas. We will develop fire protection plans for such areas in consultation with appropriate tribal or intertribal organizations. We will coordinate with tribes and appropriate tribal organizations regarding training, outreach, and other items of mutual interest in order to support tribal and national forest fire programs.
- Traditional American Indian land use practices, tribal watershed, and other ecosystem restoration practices and priorities will be considered early in national forest planning, analyses, decision making, and adaptive management processes. During landscape analyses and similar activities, we will access vegetation community conditions where a specific area has an identified importance to an affected tribe or tribal community. We will consult with affected tribes, and/or tribal communities to consider traditional and contemporary uses and needs.
- We will consider traditional American Indian vegetation management strategies and methods and integrate them, where appropriate, into ecosystem restoration activities. We will cooperate with tribes, tribal communities, and intertribal organizations to develop ecosystem stewardship projects.
- We will consider the relationship between fire management and plants culturally important to American Indians. Where fuels treatments may affect tribes or tribal communities, or plants culturally important to them, we will consult on the development of burn plans and consider approaches that accommodate traditional scheduling and techniques of fire and vegetation management.
- When implementing noxious weeds management programs, we intend to maintain or if appropriate, increase the availability of plants traditionally used by American Indians. We will consult with appropriate tribes, tribal communities or tribal organizations to identify areas of new or worsening weed infestations and develop plans for appropriate weed control.
- We will, where appropriate, include culturally significant species in monitoring protocols related to management activities.
- We will maintain appropriate access to sacred and ceremonial sites and to tribal traditional use areas. We will consult with affected tribes and tribal communities to address access to culturally important resources and culturally important areas when proposing management that may alter existing access. After appropriate assessment and consultation, we will consider proposing mineral withdrawals and other protection of inventoried sacred sites.
- We will protect all sensitive and proprietary information to the greatest extent permitted by law. We will secure permission to release information from the tribe, tribal community, or individual who provided it prior to release to others.

Chapter 2: Alternatives, including the Proposed Action

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Chapter 2: Alternatives, including the Proposed Action

2.1. Introduction

This chapter describes and compares the management alternatives considered in detail. It focuses on differences in management direction among the alternatives. It also describes additional alternatives that were initially considered but eliminated from further study and provides rationale for their dismissal.

2.2. Considering Uncertainty and Risk in the Decision

Uncertainty and *risk* are central considerations in decisions about natural resource management. A discussion of uncertainty and risk has been included here to increase understanding of the way these concepts factor into decisions concerning management of the national forests of the Sierra Nevada. Lawrence C. Walters, Ph.D., Peter J. Balint, Ph.D., Anand Desai, Ph.D., and Ronald E. Stewart, PhD., prepared the following material. The concepts described below set the stage for reviewers of this final supplemental environmental impact statement (SEIS) and provide important context for the resource issues to be addressed in the forthcoming decision.

A Consideration of Uncertainty and Risk in the Sierra Nevada Case

Regarding uncertainty and risk as they apply to the Sierra Nevada case, we find that:

- Uncertainty is a neutral analytical property of an event, relationship, phenomenon, or other important consideration that may be reduced through better science, but generally cannot be eliminated.
- Defining risk is fundamentally an expression of values and power.
- The important short-term risks facing the Forest Service are related to decision processes, not ecological outcomes.
- The Sierra Nevada management decision is a wicked problem.

Nature of Uncertainty

Uncertainty is a neutral analytical property of an event, relationship, phenomenon, or other important consideration, which may be reduced through better science, but generally cannot be eliminated.

In this context, we mean by *uncertainty* the likelihood of the occurrence of an event, relationship, phenomenon, or other important consideration. This likelihood of occurrence may be unknown, or may have a distribution of possible values, but it is not under the immediate control of Forest Service decision makers. In describing uncertainty as value neutral, we wish to highlight two important points:

- Uncertainty is used to describe probabilistic events, whether or not it is possible to quantify those probabilities. For example, the distribution of naturally occurring fire events may be calculable, and, therefore, the probability of fire during a specific time interval may be estimable. The likelihood of important budget changes as a result of shifts in national public policy priorities during the next 50 years may not be estimable. In both cases, however, *uncertain* is the analytical term used to describe the events.
- Uncertainty does not inherently involve a value position on the part of the analyst or decision maker. The probability of occurrence of a lightning strike, for example, is independent of attitudes toward fire hazard, owl habitat, or any other value position. In this sense, uncertainty is a neutral concept.

Three broad categories of uncertainty in the decision context face the Forest Service: scientific, administrative (or implementation), and stochastic.

To say that something is scientifically uncertain within the context of the Sierra Nevada decision problem is to acknowledge that forests are complex systems and that our knowledge of them is incomplete. As a result, no one can state with certainty the long-term outcome of any given management strategy, including maintaining the status quo. Examples of key areas of scientific uncertainty include:

- the acreages of old-growth forest and old-growth forest habitat determined under the various alternatives as projected by vegetation models;
- the population of old-growth dependent species associated with these projected acreages and the resulting probabilities of viability as projected by the California Wildlife Habitat Relationships Model and viability models; and
- the annual or decadal acreages burned and severity of burn as projected by such models as FLAMMAP, SPECTRUM, and FARSITE.

Scientific uncertainty is often expressed as a calculated or estimated confidence interval around a predicted value or outcome.

Administrative or implementation uncertainty refers to the vagaries of managing in a political environment in which public goals and priorities, societal needs and conditions, and organizational capacities change over time. Finally, stochastic uncertainty refers to those events that are largely random, unpredictable, and uncontrollable, such as lightning-caused ignitions or random changes in species populations.

Each of the factors is associated with specific uncertainties. In addition, the assessment of outcomes by stakeholders also involves uncertainties, as stakeholder perceptions, values, and priorities may shift over time.

Obviously, there is much that is uncertain and largely uncontrollable in this decision environment. While it is true that some uncertainties can be reduced over time through better science and organizational learning, many if not most uncertainties cannot be eliminated altogether.

The Uncertainty Dilemma

In describing and representing the scientific and stochastic uncertainties inherent in the Sierra Nevada management decision, analysts face a dilemma. On one hand, simple and accessible characterizations of the multiple uncertainties are likely to be misleading, biased, or wrong. One example may serve to make this point. Recent graphs generated by the Sierra Nevada Forest Plan Amendment (SNFPA) Review Team depict likely outcome trajectories of different management strategies over the next 140 years as lines. Objections were raised that such depictions may be misleading because they suggest that these trajectories are or can be known with certainty, or at the very least that depicted differences are real and meaningful. Those objecting argued that confidence intervals should be placed around each line, and that doing so would likely show that depicted differences in expected outcomes are significantly more uncertain than the initial graphs suggest. Whether or not the objection is valid, the point remains that lack of detail was seen to be at least misleading, likely biased, and perhaps even wrong.

But the potential remedy poses its own challenges. Detailed characterizations of uncertainty are likely to be difficult to understand and present and, consequently, may not be useful to the public or to decision makers. There is no scientific or technical solution for this dilemma. The resolution focuses on the decision processes employed. To be effective, such processes must tightly integrate analysis and broader deliberation, and should allow all participants to understand where scientists agree, where they disagree, and where their relative certainty ends (Stern and Fineberg 1996).

Defining Risk

Defining risk is fundamentally an expression of values and power.

Risk is a concept with a long pedigree in a variety of disciplines, but in virtually all technical discussions, risk is represented as having three components:

- one or more potential stressors (sometimes called hazards);
- a probability that these stressors will occur (often called exposure); and
- the likely adverse effect that will result if the stressors do occur.

It is common to compare risks based on the product of the magnitude of the loss that will occur and the probability of its occurrence. Such calculations are referred to as "expected values." In one recent example, a panel of the National Academy of Public Administration (NAPA) (Fairbanks et al. 2001) found that many federal risk assessment methods consider mostly the magnitude of hazards. The panel argues that it is necessary to develop methods that clearly include all three components of risk:

- Hazard, e.g., an area's fuel loading and dryness conditions;
- Risk or exposure, e.g., the probability of ignition; and
- Value, e.g., the physical, social, and economic costs of the potential damage.

An important observation regarding the role of value judgments in assessing risk is also made by Slovic (2000) and is incorporated in a recent study by the National Research Council (NRC) (Stern and Fineberg 1996). In any characterization of risk, these studies argue, two critical value judgments are at least implicit. First, there is the judgment that a particular process or outcome merits serious attention. The decision to focus on wildland fire hazards or old-forest owl habitat, rather than, say, the economic vitality of adjacent communities or the potential harms to black oaks, is a value judgment made by key actors. Because of the political power and influence of those key actors, one set of values prevails in characterizing the risks in a given decision. Other actors at different times could have made, and have made, different judgments.

Second, there is the judgment about what constitutes an unacceptable level of the outcome dimension. To say that some number of acres of stand-destroying fires is unacceptable reflects again the values of the decision makers. Between these two judgments, there is much room for analysis in modeling, measuring, and calculating; but these important analytical efforts should not obscure the central observation that focusing on some outcomes and not others, and on some outcome levels and not others, is a reflection of the value judgments and priorities of those making the decision. Again, which perceptions prevail in determining acceptable threshold levels of risk is a function of the influence of key actors. Our point is simply that these choices are neither objective nor purely scientific, nor could they be.

Risks Facing the Forest Service

The important short-term risks facing the Forest Service are related to decision processes, not ecological outcomes.

The NAPA discussion is useful in helping to characterize the risks facing the Forest Service in the Sierra Nevada, which are somewhat broader than fire management:

- *Long-term risk*: given observed ecosystem conditions, existing external human factors, and future natural events and processes, the probability that any particular adopted management strategy will result in a preponderance of outcomes judged undesirable by the majority of stake-holders over the long term (beyond 10 years). In addition to long-term risk, the Forest Service faces important short-term risks as well.
- *Short-term risk*: given observed ecosystem conditions, existing external human factors, and future natural events and processes, the probability that any particular adopted management strategy will be seen as undesirable by the majority of stakeholders over the near term (10 years) because it
    - results in a preponderance of undesirable outcomes,
    - violates accepted historical precedents,
    - violates widely held principles and standards of practice, or
    - violates broadly held social preferences.

What emerges from this characterization is the observation that short-term risks involve much more than just concern about uncertain outcomes or the products of the decision. While stakeholders are certainly concerned with ecological outcomes, many are willing to accept modest short-term habitat losses if potential long-term gains are great enough. Further, in the short run, none of the vegetation models or fire projections shows a significant difference among alternatives in ecological outcomes. If it is true both that stakeholders are willing to consider short-term tradeoffs, and that alternatives under consideration are indistinguishable in their short-run outcomes, then the focus of short-term risks must shift to concerns with the decision process. Attention must be paid to process, or the decision maker runs the risk of failing even though the likelihood of desirable long-term outcomes is enhanced. And this makes the *risk dilemma* all the more relevant.

The Risk Dilemma

How people perceive risk depends on

- what they value,
- how the risk is framed, and
- their level of trust in the responsible organization or institution.

It is well known, for example, that there is an inverse relationship between perceived risk and perceived benefit, and the relationship is linked to an individual's general affective evaluation of a hazard. If an activity is "liked" people tend to judge its benefits as high and its risks as low. If the activity is "disliked" the judgments are the opposite—benefits tend to be perceived as low while risks are perceived as high (Slovic 2000).

Further, and perhaps even more important, every way of presenting risk information is a *frame* that can shape the judgments of participants in a risk decision. If the issue is framed in a positive light, people are more likely to dwell on the positive aspects of the decision, and vice versa. One often cited example is the observation that summarizing medical risks in terms of mortality rates yields very different perceptions compared to when the same information is presented in terms of survival rates. If a given treatment is described as having a mortality rate of 10%, for example, it is perceived very differently than if the same treatment is said to have a survival rate of 90%. The evidence also shows that experts are not immune to these framing effects. The effect is as strong when subjects are physicians as when they are lay people. As the NRC report concludes:

> Numerous research studies have demonstrated that different but logically equivalent ways of summarizing the same risk information can lead to different understandings and different preferences for decisions (Stern and Fineberg 1996, p. 57).

It should be noted that this is not an issue that can be resolved with better science. There is no scientific way to determine that one summary of risk is more accurate or less biased than another when both accurately reflect the data. Consequently, the problem of generating a single unbiased summary of risk information to meet the needs of participants in a risk decision has no purely technical solution.

As with uncertainty, the resolution of this dilemma focuses on the decision processes employed. In this light, it is also important to note a corollary to the affective evaluation principle mentioned above: if participants trust the organization presenting the risk information, they are more likely to accept the characterization. And the level of trust is a byproduct of the decision process. Experience in a variety of settings suggests that such trust is easily damaged and difficult to restore.

Wicked Problem

The Sierra Nevada management decision is a wicked problem.

Clearly, some public problems are more difficult to resolve than others. Renn (1995) suggests that environmental debates operate on three levels of complexity, and that ecological risk assessment has *decreasing utility* as an input into policymaking as levels of complexity and conflict increase. For straightforward problems, scientific analysis can serve as a basis for policymaking with little controversy. At a medium level of complexity, public trust in the implementing institutions and their technical expertise is required. At the highest level of complexity and conflict, profound social and cultural values come into play, and stakeholder involvement is essential. In these most complex cases, the processes of defining shared values, common goals, desirable outcomes, and acceptable risks become political. Consequently, technical analyses alone, which do not integrate social values and deliberation, cannot provide an adequate decision-support framework.

To make this point more clearly, it is helpful to consider two dimensions of any decision: the state of necessary knowledge and the level of agreement on guiding values. Given these characteristics of a decision environment, there are four possible scenarios. If the knowledge base underpinning an issue is well understood and generally accepted, and the agreement on values among stakeholders is high, then decision-making is easy and stakeholders may be comfortable with an agency-expert or authoritative strategy.

If agreement on values is low, but the science is well understood, then the focus is on dialogue among the stakeholders, guided by the science, to try to understand and resolve the value differences. When the science is uncertain and there are important gaps in the knowledge base, but the stakeholder agreement on values is high, then the focus is on getting the science issues resolved, with oversight and engagement by the stakeholders when needed to assure that their values are being reflected in the science and decision-making. But when both the science is uncertain and the agreement on values is low, then the issue becomes a wicked problem, and significant dialogue among scientists, stakeholders, and decision makers is needed.

Some of the key characteristics of wicked problems are (Allen and Gould 1986):

- The definition of the problem is in the *eye of the beholder*; that is, each stakeholder defines the problem differently and therefore there is no single correct formulation of the problem.
- Outcomes are not scientifically predictable.
- The decision maker cannot know when all feasible and desirable solutions have been explored.
- The resources of ecosystems, communities of interest, funds, organizational capabilities, etc., combine with stakeholder demands in idiosyncratic ways; therefore, any solution is likely to be *one-shot* and unique.
- Solutions are generally better or worse, rather than true or false.

It is our firm belief—based on the risks and uncertainties associated with all aspects of the decision framework and the lack of a clear consensus on public values and perceptions of risk—that the Sierra Nevada planning effort is a classic wicked problem. This means there is no single correct response, some responses are better than others, and the Pacific Southwest Region must cope with the complexities and ambiguities associated with wicked problems.

2.3. Alternatives Considered in Detail

Nine alternatives are considered in detail in this SEIS: the no action alternative (Alternative S1), the proposed action (Alternative S2), and seven action alternatives from the SNFPA FEIS (Alternatives F2-F8). The no action alternative (Alternative S1) continues management in the 11 Sierra Nevada national forests consistent with the SNFPA ROD of January 2001. Alternative S2 incorporates specific changes to the SNFPA ROD to:

- pursue more aggressive fuels treatments while maintaining old forest conditions and species at risk,
- improve compatibility with the National Fire Plan to ensure that goals of community protection and forest health are accomplished,
- implement the Herger-Feinstein Quincy Library Group (HFQLG) Recovery Act pilot project to the fullest extent possible,
- reduce unintended and adverse impacts on grazing permit holders,
- reduce unintended and adverse impacts on recreation users and permit holders, and
- reduce unintended and adverse impacts on local communities.

Alternatives F2 through F8 incorporate the fire and fuels reduction strategies and standards and guidelines described under Alternatives 2 through 8, respectively, in the SNFPA FEIS.

The following sections provide detailed description of Alternatives S1 and S2. Alternatives 2 through Modified 8 of the FEIS are briefly described here as Alternatives F2-F8. Readers can also refer to the FEIS, volume 1, chapter 2, pages 83-164, for a more detailed description of these alternatives.

2.3.1. Common Elements of Alternatives S1 and S2

Fire and Fuels Management, Old Forest Ecosystems, and Associated Species Conservation

Alternatives S1 and S2 share overarching goals for fire and fuels management that include protecting communities and forests from the impacts of large, severe wildfires; changing fuels condition classes; and meeting ecological goals for re-introducing fire. Both alternatives envision a collaborative approach to the management of hazardous fuels in and around communities coupled with the strategic placement of area treatments across broad landscapes. Naturally occurring wildfires would also be used to achieve fuels reduction objectives. All initial treatments would be completed over a 20 to 25-year period. Treated areas would be maintained over time to ensure that fire behavior objectives continued to be met.

Alternative S1 and S2 have overarching goals for old forest ecosystems and associated species that are aimed at protecting, increasing, and perpetuating old forest conditions. These alternatives would maintain habitat in perpetuity that is capable of supporting well-distributed, viable populations of old forest-associated species across the Sierra Nevada national forests.

Approach for Modifying Wildfire Behavior across Broad Landscapes

The fire modification strategy adopted in the SEIS is based on the theory that disconnected fuel treatment areas overlapping across the general direction of fire spread will be effective in changing fire behavior. Research conducted by Dr. Mark Finney (1999) suggests that, even outside of treated areas, fire spread rates can be reduced if the fire is forced to flank areas where fuels have been modified. Hence, treated areas would function as "speed bumps" to slow the spread and reduce the intensity of oncoming fires. The overall effect is to reduce damage to both treated and untreated areas and the temper the consequences of large, uncharacteristically severe wildfires. Follow-up treatments in these areas are important to prevent grass and shrub colonization that would increase burn rates over time.

Dr. Finney's research findings indicate that, given an effective treatment area shape and pattern, only a fraction of the landscape needs to be treated and maintained to produce the desired change in wildfire behavior over the entire landscape. This hypothesis underpins the fire and fuels strategy in Alternatives S1 and S2. Although computer modeling supports Dr. Finney's hypothesis, the approach has not been tested on an actual landscape. Alternative hypotheses and the risks and uncertainties associated with them are discussed more fully in chapter 4.

An estimated 7.5 million acres in the eleven Sierra Nevada national forests are considered to be at high to very high fire risk. (Refer to the fire hazard and risk maps in the SNFPA draft environmental impact statement [DEIS] and the SNFPA FEIS [volume 2, page 256].) Fuels treatments would be located within these areas of the Sierra Nevada national forests. Alternatives S1 and S2 include the strategic placement of area treatments, ranging in size from 50 to over 1,000 acres (generally averaging between 100 to 300 acres), across landscapes to interrupt fire spread and thereby reduce the size and severity of wildfires.

Design Criteria for the Pattern of Area Treatments

Under Alternative S1 and S2, managers would determine the size, location, and orientation of fuels treatments at a landscape-scale. Managers would use information about fire history, existing vegetation and fuels condition, prevailing wind direction, topography, suppression resources, attack times, and accessibility to design an effective treatment pattern. The spatial pattern of the treatments would be designed to reduce rate of fire spread and fire intensity at the head of the fire.

In planning landscape-level treatment patterns, managers would incorporate those areas that already contribute to modification of wildfire behavior, including timber sales, burned areas, bodies of water, and barren ground. Managers would identify gaps in the landscape pattern where fire could spread at some undesired rate or direction. Treatments (including initial and maintenance fuels treatments) would be used to fill identified gaps. Alternative S2 includes additional design criteria and resource considerations for managers to use in planning the layout of area treatments.

Land Allocations

Both Alternatives S1 and S2 use the following land allocations (outside of the HFQLG pilot project area) as part of an overall strategy for conserving old forest ecosystems and species and managing fire and fuels:

- California spotted owl and northern goshawk protected activity centers (PACs),
- California spotted owl home range core areas (HRCAs),
- the WUI,
- old forest emphasis areas,
- southern Sierra Nevada fisher conservation areas, and
- general forest.

The two alternatives differ in the specific management direction that applies within each land allocation. A ranking order is assigned to land allocations, and management direction for a higher ordered land allocation pre-empts direction for another land allocation when two (or more) allocations overlap on the ground. The ordering is similar in Alternative S1 and S2 and is described in more detail under each alternative.

2.3.2. Alternative S1 - No Action

Theme and Overall Management Approach

The no-action alternative (Alternative S1) would continue management in the eleven Sierra Nevada national forests consistent with the SNFPA ROD. This alternative reflects concerns that impacts from mechanical fuels treatments pose greater risks to habitats, particularly in the short-term, than risks posed by wildfires. Alternative S1 involves a cautious approach for conducting activities in habitats for sensitive species, particularly species associated with old forest ecosystems. Alternative S1 includes standards and guidelines for retaining canopy cover and limiting the sizes of trees that can be removed during fuels treatments, and for imposing limited operating periods on activities in the vicinity of certain species' nest and den sites. Because of specific stand-structural retention standards, fuel treatment objectives may be compromised in landscapes with high proportions of suitable California spotted owl habitat (FEIS, volume 2, chapter 3, page 305). Under Alternative S1, vegetation treatments are limited to fire hazard reduction and maintenance of treated areas.

The no-action alternative also provides direction for limiting and, in some cases, eliminating grazing from habitat that is or has been occupied by the Yosemite toad or willow flycatcher. This alternative requires limited operating periods for all new resource management activities in the vicinity of California spotted owl and northern goshawk nest sites and forest carnivore den sites. Limited operating periods may apply to existing recreation and road and trail use, if analysis of proposed activities indicates that they are likely to result in nest or den site disturbance.

Land Allocations

Land allocations under Alternative S1 are ranked so that management standards and guidelines for a higher ranked land allocation pre-empt direction for lower ranked land allocations, where overlap occurs. However, because management direction is generally based on individual stand conditions, most of the standards and guidelines for mechanical fuels treatments are the same for California spotted owl HRCAs, WUI threat zones, old forest emphasis areas, and general forest. When differences occur, land allocations for Alternative S1 are ranked as follows:

(a) California spotted owl and northern goshawk PACs,

(b) WUI defense zones,

(c) WUI threat zones (where there is sufficient suitable owl habitat),

(d) California spotted owl HRCAs, WUI threat zones (where there is <u>not</u> sufficient suitable owl habitat), old forest emphasis areas, and general forest.

This ranking means that where a PAC overlaps another land allocation, standards and guidelines for the PAC supercede standards and guidelines for the overlapped land allocation.

Standards and Guidelines for Area Treatments

Alternative S1 includes standards and guidelines that specify either (1) the allowable types or extents of vegetation treatments in certain areas or (2) limits on amounts of vegetative material that can be removed through mechanical treatments. These standards and guidelines are designed to (1) mitigate the potential risks to old-forest-associated species and their habitats and (2) conserve likely important components of habitat for old-forest-associated species, such as stands of mid and late seral forests with large trees, structural diversity and complexity, and moderate to high canopy cover.

Prescribed burning is the only treatment option for PACs outside of defense zones. Limits are place on the total *number* of PACs in the bioregion that could be directly affected by fuels treatments. Vegetation treatments may intersect up to 5% of all PACs in the bioregion per year and 10% per decade. Standards and guidelines for old forest emphasis areas and California spotted owl HRCAs encourage the use of prescribed fire over mechanical treatments.

Standards and guidelines for mechanical treatments limit the sizes of trees and amount of canopy cover that can be removed. In addition, a portion of each stand must remain untreated. Management direction is applied on a stand-by-stand basis. As a result, the existing stand condition, rather than the land allocation, generally dictates which standards and guidelines apply.

With some exceptions (Table 2.3.2a), mechanical treatments in areas outside of the defense zone are limited to (1) removing trees having diameter at breast height (dbh) of less than 12 inches, and (2) reducing the canopy cover of dominant and codominant trees by no more than 10%. Alternative S1 does not place restrictions on the amounts of material removed through prescribed burning.

A complete set of standards and guidelines for Alternative S1 is provided in Appendix A and is included in the SNFPA ROD.

Table 2.3.2a. Exceptions to 12-inch Diameter and/or 10% Canopy Cover Reduction Limits for Mechanical Fuels Treatments.

Stand Condition and Land Allocation	Standards and Guidelines
All CWHR size classes in defense zones	Mechanical treatments may remove trees up to 30 inches dbh (24 inches dbh in the eastside pine forest type). No canopy cover restrictions apply.
CWHR size classes 3, 4, and 5 with canopy cover 40-50% (all allocations outside defense zones)	Mechanical treatments may only remove trees less than 6 inches dbh.
CWHR types 4M and 4D in old forest emphasis areas and California spotted owl HRCAs where the following conditions are met: ▪ amount of habitat is sufficient to meet home range core acreage requirement, and ▪ treatments beyond prescribed burning and removing material less than 12 inches are needed to meet fuels objectives	Mechanical treatments may: ▪ remove trees less than 20 inches dbh and ▪ reduce canopy cover provided by dominant and codominant trees by no more than 20%.
CWHR types 4M and 4D in threat zones where the following condition is met: ▪ amount of habitat is sufficient to meet HRCA acreage requirement	
CWHR types 3S, 3P, 4S, 4P, 5S, 5P in threat zones and general forest, and CWHR types 4M and 4D in general forest	

CWHR = California Wildlife Habitat Relationships system

Herger-Feinstein Quincy Library Group Forest Recovery Act Pilot Project

Under Alternative S1, the standards and guidelines in the SNFPA ROD apply to the HFQLG Forest Recovery Act pilot project with one exception. Instead of the SNFPA aquatic management strategy, the

Scientific Analysis Team (SAT) guidelines for managing riparian areas apply to all vegetation management activities in the pilot project area for the life of the pilot project.

Standards and Guidelines for Sensitive Species and Meadow Ecosystems

Willow Flycatcher

Under Alternative S1, grazing would be eliminated or significantly restricted in meadows where willow flycatchers have historically been detected. In addition, suitable habitat within a 5-mile radius of these meadows would be surveyed by the year 2006. Detection of willow flycatchers in other locations within active allotments would result in late-season grazing restrictions (i.e. after August 31). Late season grazing restrictions would also apply where required surveys have not been completed in the specified timeframe, until they are conducted and yield no detections.

Definitions of Willow Flycatcher Site Occupancy

The definitions (known, occupied, unoccupied) for willow flycatcher sites as defined in the SNFPA FEIS remain the same for this alternative. The SNFPA FEIS defined *known* willow flycatcher sites as meadows or riparian areas with documented willow flycatcher presence during the breeding season, specifically, either:

1. willow flycatcher observed between June 15 and August 1;

OR

2. willow flycatcher observed between June 1 - June 14, or August 2 - August 15, unless willow flycatcher was:
    - absent during surveys conducted between June 15 and July 15 in the same year,
    - absent during June 15 to July 15 surveys in multiple subsequent years, or
    - detected at a site that is clearly outside of known habitat requirements.

Yosemite Toad

Under Alternative S1, livestock (including pack stock and saddle stock) would be excluded from habitat occupied by Yosemite toads (i.e. standing water and saturated soils) during the breeding and rearing seasons. Where it is not practical to exclude livestock from the occupied portions of meadows, livestock would be excluded from the entire meadow. Surveys of suitable habitat within the species historic range would be completed by 2004. Livestock would be excluded from suitable habitat that has not been surveyed within the time allotted, until such work is completed.

Great Gray Owl

Alternative S1 requires that herbaceous vegetation in meadow areas of great gray owl PACs be maintained 12 inches high or greater and cover at least 90% of the meadow.

Species Associated with Old Forests

Alternative S1 includes standards and guidelines that require limited operating periods for all new resource management activities in the vicinity of nest sites for the California spotted owl and northern goshawk and furbearer den sites. Limited operating periods may apply to existing recreation and road and trail use where analysis of proposed projects or activities indicates that such activities are likely to disturb nest or den sites.

Meadow Ecosystems

For season-long grazing, Alternative S1 limits utilization of grass and grass-like plants in meadows in early-seral status to 30% (or minimum 6-inch stubble height). For meadows in late seral status, utilization is limited to 40% (or minimum 4-inch stubble height).

Adaptive Management, Monitoring Strategy, and Strategic Planning

Alternative S1 would include the concepts of adaptive management and monitoring as described in the SNFPA ROD and Appendix E of the SNFPA FEIS. The focus would be on testing "new and innovative management techniques" using formal adaptive management research projects or administrative studies done in conjunction with the Pacific Southwest Research Station or other scientific research institutions.

Under the auspices of adaptive management, an administrative study in the HFQLG Pilot Project Area would be initiated to examine the effects of management-caused changes in vegetation on spotted owl habitat and population dynamics.

A monitoring team would orchestrate regional data collection and work in close collaboration with the Pacific Southwest Research Station. A monitoring and evaluation report for the Sierra Nevada would be completed each year. Monitoring results would be evaluated each year in collaboration with appropriate federal and state agencies. When monitoring indicated a need to change resource management, this would be accomplished through forest plan amendments or revisions.

2.3.3. Alternative S2 - Proposed Action

Theme and Overall Management Approach

Under the proposed action (Alternative S2), Forest Service managers would use thinning, salvage, and prescribed and natural fires to make forests less susceptible to the effects of uncharacteristically severe wildfires, as well as invasive pests and diseases. Goals established in the SNFPA ROD for conservation of old forest ecosystems and associated species would be retained. However, this alternative also provides for other important elements of old forest ecosystems, including the objectives of reducing stand density and regenerating shade intolerant species.

Alternative S2 would adopt an integrated vegetation management strategy with the primary objective of protecting communities and modifying landscape-scale fire behavior to reduce the size and severity of wildfires. This alternative would provide for the removal of some medium-sized trees to increase the likelihood of accomplishing program goals with limited funding. Alternative S2 acknowledges the role that the Forest Service plays in providing a wood supply for local manufacturers and sustaining a part of the employment base in rural communities. This alternative would address the need to retain industry infrastructure by allowing wood by-products to be generated from fuels treatments and for dead and dying trees to be salvaged after wildfires. This active approach to vegetation and fuels management accepts the risks of temporarily changing some habitat for California spotted owls and other species to reduce the future risk of wildfire to habitat and human communities.

Alternative S2 would include the SNFPA ROD's network of land allocations, with some modification and clarification of the associated desired conditions. Alternative S2 would replace many of the standards and guidelines in the SNFPA ROD pertaining to old forest ecosystems, associated species conservation, and fire and fuels management. Alternative S2's replacement standards and guidelines would give greater flexibility to local managers to design projects to respond to local conditions, while meeting desired future conditions unique to each land allocation.

Pending completion of the forest plan amendments/revisions required by the HFQLG Forest Recovery Act, vegetation management activities on the Plumas and Lassen National Forests and the Sierraville Ranger District of the Tahoe National Forest would be guided by the direction of Alternative S2. Alternative S2 provides for implementation of the HFQLG Forest Recovery Act Pilot Project and employs the land allocations specified in the Act for the life of the pilot project. As in Alternative S1, vegetation management in riparian areas within the HFQLG Pilot Project Area would be handled under the SAT guidelines for the life of the pilot project.

Alternative S2 also includes standards and guidelines for managing grazing within habitat that is or has been occupied by the Yosemite toad and willow flycatcher. This management direction is designed to allow local managers to develop site-specific approaches to meet overall program goals for species conservation. Some flexibility is provided to allow managers to take advantage of unique opportunities that can only be identified at the project-level. This alternative would invoke limited operating periods for vegetation treatments in the vicinity of nest sites for California spotted owl and northern goshawk and near furbearer den sites.

Approach for Modifying Wildfire Behavior across Broad Landscapes

Section 2.3.1 "Common Elements of Alternatives S1 and S2" describes the approach under Alternative S2 for modifying fire behavior across broad landscapes. Alternative S2 explicitly recognizes two criteria that must be met for the strategy to be effective: the *pattern* of area treatments across the landscape must interrupt fire spread, and treatment *prescriptions* must be designed to significantly modify fire behavior within the treated area. Outside the HFQLG Pilot Project Area, 50% of initial fuels treatments under Alternative S2 would be located in the WUI. This percentage would apply at the bioregional scale until all treatments in the WUI have been completed.

Resource Considerations in Planning Treatment Areas Patterns

Alternative S2 would require a landscape-level design of fuels treatment patterns to be completed prior to project implementation. Treatment patterns would be developed using a collaborative, multi-stakeholder approach. Resource considerations to factor into the strategic placement of fuels treatments include the objectives of locating treatments to overlap areas of condition class two and three, high density stands, and pockets of insect and disease. Where consistent with fuels treatment objectives, small inclusions of stands classified as CWHR 5M, 5D and 6 would be avoided during project-level planning and implementation.

Under Alternative S2, managers would be directed to adjust the placement of treatment areas to avoid PACs to the greatest extent possible. PACs could be re-mapped during project planning to avoid intersections with treatment areas, provided that the re-mapped PACs contained habitat of equal quality, and included known nest sites and important roost sites. When it was necessary for treatment areas to intersect PACs, attempts would be made to avoid entering the PACs that contribute most to productivity of California spotted owls. Listed below are measures of PAC productivity that would be considered in choosing among alternative treatment patterns. The criteria are ranked in order of priority for avoidance.

1. PACs currently or historically supporting reproduction.
2. PACs currently occupied by pairs.
3. PACs currently occupied by territorial singles.
4. PACs currently unoccupied but historically occupied by pairs.
5. PACs currently unoccupied but historically occupied by territorial singles only.

Alternative S2 includes standards and guidelines that limit the acreage of PACs that could be treated throughout the Sierra Nevada national forests to no more than 5% of the total acreage of PACs in the bioregion each year. No more than 10% of the total acreage could be treated each decade.

Prescriptions for Area Treatments

Fuels treatment prescriptions would be designed to meet desired surface, ladder, and crown fuel conditions. Site-specific prescriptions would be designed to modify fire intensity and spread in treated areas. Managers would consider topographic position; slope steepness; predominant wind direction; and the amount and arrangement of surface, ladder, and crown fuels in developing fuels treatment prescriptions for each treated area. The first priority for fuels treatment would be to reduce surface and ladder fuels. Crown fuels would be modified to reduce the potential for spread of crown fire.

Fuels objectives would have first priority in the design of treatment areas. However, prescriptions for treatment areas would also address identified needs for increasing stand resistance to mortality from insects and disease. Thinning densely stocked stands could be used to reduce competition and improve tree vigor thereby reducing levels of insect- and disease-caused mortality.

Opportunities for Leveraging Appropriated Funds to Accomplish Fuels Treatments

Under Alternative S2, revenues from the sale of commercial forest products could be obtained from some fuels treatments. This would increase the likelihood of accomplishing the projected acres of treatment, an essential first step in achieving the desired reductions in acres burned. Where consistent with desired conditions, area treatments would be designed to be economically efficient and meet multiple objectives.

Timber sale contracts provide a mechanism for the efficient removal of commercially-valuable sawtimber. Contracts that have sufficient value offer capabilities for funding the accomplishment of additional resource management goals. Records from recent timber offerings indicate that sales with higher volumes per acre attract higher bids. Sales yielding an average 4.5 mbf/acre provide approximately $112/mbf, compared to only $38/mbf for 1.5 mbf/acre (Landram, pers comm).

The size of tree made available for harvest has a significant influence on sale volume per acre averages and thus, per unit bid values. Assuming typical heights, the board foot volume for a 12-inch dbh tree is 39, compared to 317 for a 20 inch tree and 710 for a 24 inch tree. Using these assumptions, 77 twelve-inch dbh trees would be needed to reach the minimum economically feasible sale volume (estimated at 3 mbf/acre). This compares to 9 trees of 20-inch dbh and 4 trees of 24-inch dbh. In summary, including only a few medium-sized trees can make a impact on the economic viability of a given project.

A number of options are available for deriving commercially-valuable wood products from fuels treatments. Where wood-fired electrical generation facilities exist and sufficient sawtimber value is present, small trees, e.g. biomass, can be removed. Bids in excess of required collections may also be made available for fuel reduction treatments within the sale area boundary. These treatments may include:

1) Shredding of ladder fuels, i.e. small trees, woody shrubs, and surface fuel,
2) Prescribed fire treatments following timber harvest, or
3) Fuel reduction treatments outside timber sale units (within the timber sale area boundary).

Alternatively, a stewardship contract package (a service contract, not a timber sale contract), that includes commercially-valuable sawtimber, may provide for cost-effective implementation of multiple fuels reduction projects within the contract area.

Ecosystem Restoration Following Catastrophic Disturbance Events

A catastrophic event occurs in a relatively short period of time and alters natural conditions beyond the range of conditions that are compatible with resource objectives for the affected area. After a catastrophic event, habitat once suitable for sensitive species may be rendered unsuitable for many years.

Under Alternative S2, restoration activities after catastrophic events are intended to gradually restore forest species composition and structure. Restoration activities include removal of excess dead wood (through salvage harvest, mechanical removal of non-merchantable material, prescribed fire, or a combination of these activities) and reforestation (through combinations of site preparation and planting, site preparation for natural regeneration, natural regeneration without site preparation, release, and animal damage control).

Restoration activities would be undertaken where forest succession is otherwise expected to create conditions outside the range of desired species composition and structure. For example, after a wildfire, a forest originally containing five tree species may develop over 30 to 50 years into a less complex manzanita- and whitethorn ceanothus-dominated shrubfield. This condition would eventually be succeeded by a sparse white fir and incense cedar tree forest with high fuel loads. Through active restoration, burned trees would be removed and the site would be reforested to reduce predicted fuel loads, regenerate all five tree species, and continue the successional path toward a moderately dense tree cover. The intent for restoring ecosystems following catastrophic drought, insect, disease, and wind events is similar. Action is urgent because delays limit options and decrease the likelihood of success.

Under Alternative S2, ecosystem restoration projects could be implemented in all land allocations. Managers would determine the need for ecosystem restoration projects following large, catastrophic disturbance events (wildfire, drought, insect and disease infestation, windstorm, and other unforeseen events). Objectives for these restoration projects would include limiting fuel loads over the long term, restoring habitat, and recovering economic value from dead and dying trees. In accomplishing restoration goals, these long-term objectives would be balanced with the short-term objective of reducing hazardous fuel loads.

Under Alternative S2, salvage harvest of dead and dying trees could be conducted to recover the economic value of this material and to support objectives for reducing hazardous fuels, improving forest health, re-introducing fire, and/or speeding recovery of old forest conditions. With some specific exceptions, salvage harvest would be allowed in all land allocations. In the WUI, treatments in PACs could remove salvage material to meet fuels objectives; outside of the WUI, salvage harvest would generally not be allowed in PACs that continued to be actively used.

Land Allocations

A set of desired conditions, management intent, and vegetation and fuels management objectives would apply to each land allocation under Alternative S2. These three elements would provide direction to land managers for designing and developing fuels and vegetation management projects that were consistent with the alternative’s objectives for actively managing fire and fuels, old forest ecosystems, and California spotted owl habitat. In designing the strategic layout of treatments, managers would ensure that treatment patterns and prescriptions were consistent with the desired conditions, management intents, and objectives for the relevant land allocations, as well as the project-specific management standards and guidelines described in the next section. This assumption was explicitly incorporated in the analysis of environmental effects.

Land allocations for Alternative S2 are ranked so that management direction for a higher ranked land allocation overrides direction for a lower ranked land allocation when land allocations overlap. Land allocations for Alternative S2 are ranked as follows:

1. California spotted owl and northern goshawk PACs,
2. WUI defense zones,
3. California spotted owl HRCAs,
4. WUI threat zones,
5. old forest emphasis areas, and
6. general forest.

This ranking means that where an HRCA overlaps a WUI threat zone, managers would apply the desired conditions, management intent, and management objectives for HRCAs to the area of overlap.

Table 2.3.3a displays the desired conditions, management intent, and objectives for fuels and vegetation management activities within each land allocation.

Table 2.3.3a. Desired Conditions, Management Intent, and Management Objectives for Each Land Allocation under Alternative S2.

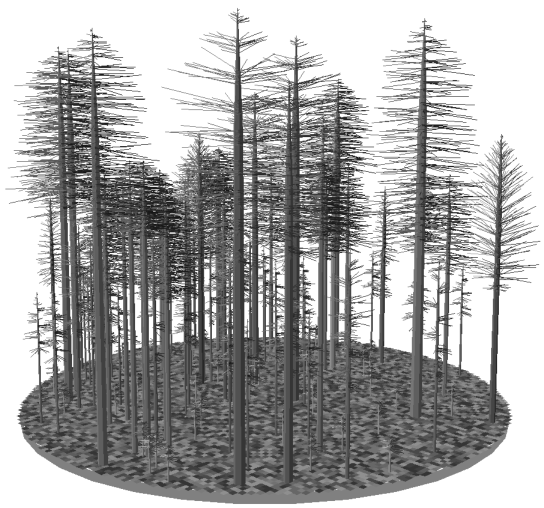
Land Allocation	**Desired Conditions**	**Management Intent**	**Management Objectives**
PACs	▪ At least two tree canopy layers are present. ▪ Dominant and co-dominant trees average at least 24 inches dbh. ▪ Area within PAC has 60- 70% canopy cover. ▪ Some very large snags are present (>45 inches dbh). ▪ Levels of snags and down woody material are higher than average.	▪ Maintain PACs so that they continue to provide habitat conditions that support successful reproduction of California spotted owls and northern goshawks.	▪ Avoid vegetation and fuels management activities within PACs to the greatest extent feasible. ▪ Reduce hazardous fuels in PACs in defense zones where conditions present unacceptable fire threat to communities. ▪ Where PACs cannot be avoided in the strategic placement of treatments, ensure effective treatment of surface, ladder, and crown fuels within treated areas.
WUI *Defense Zones*	▪ Stands are fairly open and dominated primarily by larger, fire tolerant trees. ▪ Surface and ladder fuel conditions are such that crown fire ignition is highly unlikely. ▪ The openness and discontinuity of crown fuels, both horizontally and vertically, result in very low probability of sustained crown fire.	▪ Prioritize fuels treatments in this land allocation. ▪ Protect communities from wildfire and prevent the loss of life and property. ▪ The highest density and intensity of treatments are located within the WUI.	▪ Create defensible space near communities, and provide a safe and effective area for supressing fire. ▪ Design economically efficient treatments to reduce hazardous fuels.

Land Allocation	Desired Conditions	Management Intent	Management Objectives
HRCAs	Within home ranges, HRCAs consist of large habitat blocks having: ▪ at least two tree canopy layers. ▪ at least 24 inches dbh in dominant and co-dominant trees. ▪ a number of very large (>45 inches dbh) old trees. ▪ at least 50-70% canopy cover. ▪ Higher than average levels of snags and down woody material.	▪ Treat fuels using a landscape approach for strategically placing area treatments to modify fire behavior. ▪ Retain existing suitable habitat, recognizing that habitat within treated areas may be modified to meet fuels objectives. ▪ Accelerate development of currently unsuitable habitat (in non-habitat inclusions such as plantations) into suitable condition. ▪ Arrange treatment patterns and design treatment prescriptions to avoid the highest quality habitat (CWHR types 5M, 5D, and 6) wherever possible.	▪ Establish and maintain a pattern of fuels treatments that is effective in modifying wildfire behavior. ▪ Design treatments in HRCAs to be economically efficent and to promote forest health where consistent with habitat objectives.
WUI *Threat Zones*	Under high fire weather conditions, wildland fire behavior in treated areas is characterized as follows: ▪ Flame lengths at the head of the fire are less than 4 feet. ▪ The rate of spread at the head of the fire is reduced to at least 50% of pre-treatment levels. ▪ Hazards to firefighters are reduced by keeping snag levels to 2 per acre. ▪ Production rates for fire line construction are doubled from pre-treatment levels.	▪ Priority area for fuels treatments. ▪ Fuels treatments in the threat zone provide a buffer between developed areas and wildlands. ▪ Fuels treatments protect human communities from wildland fires as well as minimize the spread of fires that might originate in urban areas. ▪ The highest density and intensity of treatments are located within the WUI.	▪ Establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior. ▪ Design economically efficient treatments to reduce hazardous fuels.

Land Allocation	Desired Conditions	Management Intent	Management Objectives
SSFCA	▪ Within known or estimated female fisher home ranges (4,500-8,000' elevation, mixed black oak/conifer) outside the WUI, a minimum of 50% of the forested area has ≥ 60% canopy cover. ▪ Where home range information is lacking, use HUC 6 watershed as the analysis area for this desired condition.	▪ Maintain high quality fisher habitat in the SSFCA to support successful reintroduction of fisher and a source population for recolonization of unoccupied, suitable habitat throughout the Sierra Nevada. ▪ Retain existing suitable habitat to the extent possible (CWHR 4D, 5D and 6), recognizing that habitat within treated areas may be modified to meet fuels objectives. ▪ Provide for heterogenous landscapes that may allow torching and small stand-replacing runs but will be resilient and retain-at a minimum-large tree elements to provide for future habitat and seed trees.	▪ When high quality fisher habitat in defense zones is treated, ensure effective treatment of surface, ladder, and crown fuels to create definsible space around communities. ▪ Within treated areas outside the defense zone, use irregular or clumpy treatments to maintain well dispersed or potential den sites. ▪ Moderate effects of fuels treatments on fisher wherever possible. Consider lighter treatments with a higher return interval to retain important habitat elements (e.g. retention of higher volume of down logs or shrub components) followed by treatments at 5 year intervals to reduce surface fuels as needed to achieve desired fuel conditions. ▪ Where high quality fisher habitat cannot be avoided during the strategic placement of treatments, consider scheduling the pace of treatments to spread impacts over a longer period of time.

Land Allocation	Desired Conditions	Management Intent	Management Objectives
Old Forest Emphasis Areas	▪ Forest structure and function resemble pre-settlement conditions, as indicated on the graphic, next page. ▪ High levels of horizontal and vertical diversity exist within 10,000 acre landscapes. ▪ Stands are composed of roughly even-aged plant groups, varying in size, species composition, and structure. Individual stands range from less than 0.5 to more than 5 acres in size. ▪ Tree sizes range from seedlings to very large diameter trees. ▪ Species composition varies by elevation, site productivity, and related environmental factors. ▪ Multi-tiered canopies, particularly in older forests, provide vertical heterogeneity. ▪ Dead trees, both standing and fallen, meet habitat needs of old-forest-associated species. ▪ Where possible, areas treated for fuels also provide for the successful establishment of early seral stage vegetation.	Maintain or develop old forest habitat in: ▪ Areas containing the best remaining large blocks or landscape concentrations of old forest. ▪ Areas that provide old forest functions (such as connectivity of habitat over a range of elevations to allow migration of wide-ranging old-forest-associated species). Establish and maintain a pattern of area treatments that is effective in: ▪ Modifying fire behavior. ▪ Culturing stand structure and composition to resemble pre-settlement conditions. ▪ Reducing susceptibility to insect/drought-related tree mortality. ▪ Focus management activities on the short-term goal of reducing the immediate threat of wildfire. Acknowledge the need for a longer-term strategy to restore both the structure and processes of these ecosystems.	▪ Establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior. ▪ Maintain and/or establish appropriate species composition and size classes. ▪ Reduce the risk of insect/drought-related mortality by managing stand density levels. ▪ Design economically efficient treatments to reduce hazardous fuels.
General Forest	▪ Same as above	▪ Actively manage general forest areas to maintain, and enhance a variety of vegetative conditions. ▪ Strategically place fuels treatments to modify wildfire behavior. ▪ Reduce hazardous fuels in key areas to lessen the threat of high severity fire.	▪ Establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior. ▪ Reduce the risk of insect/drought-related mortality by managing stand density levels. ▪ Design economically efficient treatments to reduce hazardous fuels.

Figure 2.3.3a. This graphic depicts desired conditions for old forest emphasis areas.



Standards and Guidelines for Area Treatments

The standards and guidelines in Alternative S2 are intended to (1) act as sideboards for local managers as they design projects to meet vegetation management objectives and respond to site-specific conditions, and (2) retain important components of habitat that are believed to be important to old-forest-associated species, including large trees, structural diversity and complexity, and moderate to high canopy cover. At the project level, these standards and guidelines are used along with the desired future condition, management intents and management objectives for the relevant land allocation to determine appropriate treatment prescriptions.

Prescribed burning is the only treatment option for PACs outside of WUIs. The extent of treatments in California spotted owl PACs is limited to no more than 5% of total PAC acreage per year and 10% of the PAC acreage per decade across the bioregion. Outside of PACs, managers can use either mechanical thinnings, salvage harvests, prescribed fire, or wildfire to conduct vegetation and fuels management. The vegetation management standards and guidelines apply only to thinning and, where specified, salvage harvest. All other activities that manipulate or remove vegetation (for example, land use, hazard tree removal, special use permits, etc.) are managed under existing forest plan direction and/or other authorities, as applicable.

Alternative S2 includes standards and guidelines for mechanical treatments that direct managers to design projects to retain larger trees as well as canopy cover. These standards and guidelines are applied across a treatment unit, based on aggregates of mature forest stands (CWHR classes 4M, 4D, 5M, 5D, and 6) within the unit. Alternative S2 does not require managers to retain minimum amounts of material following prescribed burning.

Tables 2.3.3b, c, and d display forest-wide standards and guidelines for mechanical thinning treatments under Alternative S2. Note that, with the exception of the defense zone, the standards and guidelines are the same for all land allocations. Within a given land allocation, management direction is distinguished according to groups of CWHR types and/or tree species (eastside pine).

A complete set of standards and guidelines for Alternative S2 is provided in Appendix A.

Table 2.3.3b. Alternative S2 Forest-Wide Standards and Guidelines for Mechanical Thinning in CWHR Types 4M, 4D, 5M, 5D, and 6 (Outside of Defense Zones and the Eastside Pine Type).

Management Intent	Standards and Guidelines
Maintain and develop old forest habitat conditions by emphasizing retention of larger trees.	Design projects to retain at least 40% of the existing basal area, generally consisting of the largest trees in each treatment unit.
Ensure recruitment of very large trees across the landscape by designing projects to retain larger trees. To permit operations, exceptions are allowed; however, projects will be designed to minimize operability impacts to trees ≥30 inches dbh wherever practicable.	Design projects to retain all live trees ≥30 inches dbh ; exceptions allowed for operability.
Allow project designers to balance the need to retain or develop understory structure as an important old forest habitat component with the need to reduce ladder and crown fuels.	Where possible, retain 5% or more of the total post-treatment canopy cover within the treatment unit in lower layers composed of trees 6-24 inches dbh.
Maintain high levels of canopy cover whenever it is possible to do so and still meet project objectives.	Where vegetative conditions permit, design projects to retain at least 50% canopy cover after treatment within the treatment unit, except where site-specific project objectives cannot be met (for example, achieving adequate height to live crown, providing sufficient spacing for equipment operation, minimizing re-entry, or realizing economically efficient treatments). Where 50% canopy cover retention cannot be met as described above, design projects to retain at least 40% canopy cover within the treatment unit.
Where canopy cover is at or near 40%, maintain canopy closure conditions suitable for dispersal and foraging for California spotted owls, while also allowing for effective fuels treatments.	Where pre-treatment canopy cover is at or near 40%, design projects to remove only surface and ladder fuels.
Avoid making significant changes in canopy density.	Design projects to avoid reducing pre-existing canopy cover by more than 30% within the treatment unit. Percent is measured in absolute terms (for example, do not reduce 80% canopy closure to less than 50%).

Table 2.3.3c. Alternative S2 Forest-Wide Standards and Guidelines for Mechanical Thinning in the Eastside Pine Type (CWHR Types 4M, 4D, 5M, 5D, and 6).

Intent	Standards and Guidelines
Maintain and develop old forest conditions in the eastside pine type by emphasizing retention of larger trees.	Design projects to retain at least 30% of the basal area in each treatment unit, generally consisting of the largest trees.
Ensure recruitment of very large trees across the landscape by designing projects to retain larger trees. To permit operations, exceptions are allowed; however, projects will be designed to minimize impacts to trees ≥30 inches.	Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability.

Table 2.3.3d. Alternative S2 Forest-Wide Standards And Guidelines for Mechanical Thinning in All CWHR Types in Defense Zones and in CWHR Types 1, 2, and 3 Outside of Defense Zones.

Intent	Standards and Guidelines
Ensure recruitment of very large trees across the landscape by designing projects to retain larger trees. To permit operations, exceptionsaare allowed; however projects will be designed to minimize impacts to trees ≥30-inches.	Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability.

Herger-Feinstein Quincy Library Group Forest Recovery Act Pilot Project

Under Alternative S2, the Lassen and Plumas National Forests and the Sierraville Ranger District of the Tahoe National Forest would implement the HFQLG Forest Recovery Act Pilot Project, consistent with the HFQLG Forest Recovery Act and Alternative 2 of the HFQLG EIS.

The HFQLG Forest Recovery Act pilot project is designed to test and demonstrate the effectiveness of certain fuels and vegetation management activities in meeting ecologic, economic, and fuel reduction objectives. Fuels and vegetation management activities include constructing a strategic system of defensible fuels profile zones (DFPZs), group selection, and individual tree selection. A management program for riparian areas is also included in the pilot project.

Alternative S2 includes the following direction for the HFQLG Forest Recovery Act Pilot Project activities[1], and non-pilot project activities, where specifically noted:

- Apply land allocations to the Lassen and Plumas National forests, and the Sierraville Ranger District of the Tahoe National Forest, which are described in the HFQLG Forest Recovery Act ROD and FEIS, with the exception that the land allocations for goshawk territories and marten and fisher habitat management areas do not apply. Apply the standards and guidelines found in Table 2.3.3e to the previously noted HFQLG Forest Recovery Act ROD and FEIS land allocations. Use Table 2.3.3e when a conflict raises between existing forest plan standards and guidelines and the management direction in Table 2.3.3e.
- Apply SNFPA standards and guidelines for management of goshawk protected activity centers (PACs), and forest carnivore den sites. Apply SNFPA standards and guidelines for management of goshawk PACs, with the caveat that DFPZs may be constructed within goshawk PACs, subject to the following limitations. In goshawk PACs, prohibit mechanical treatments within a 500-foot radius buffer around nest trees. Allow prescribed burning within the 500-foot radius buffer. Prior to burning, conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), within a 1-2 acre area surrounding known nest trees as needed to protect nest trees and trees in their immediate vicinity. The remaining area of the PAC may be mechanically treated to achieve the fuels reduction strategy of the DFPZ. Conduct mechanical treatments in no more than 5 percent per year and 10 percent per decade of the total acres in goshawk PACs within the 11 Sierra Nevada national forests.
- Apply SNFPA standards and guidelines for management of forest carnivore den sites, including marten and fisher.
- Implement the resource management activities mandated by the HFQLG Forest Recovery Act.

[1] "HFQLG Forest Recovery Act Pilot Project activities" are those activities set forth in the HFQLG Forest Recovery Act and Alternative 2 of the HFQLG EIS, such as DFPZ construction, group selection, individual tree selection, and riparian restoration.

- Apply SAT Guidelines, as set forth in the HFQLG EIS and ROD to vegetation management actions that are proposed for fuels reduction, timber management, area thinning, prescribed fire and salvage harvest within the Pilot Project Area for the life of the pilot project.
- Continue the long-term strategy for anadromous fish-producing watersheds for the Lassen National Forest, as set forth in Appendix I of the *Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement* (January 2001).

For forest management activities on the Lassen and Plumas National Forests and the Sierraville Ranger District of the Tahoe National Forest that are not part of the HFQLG Pilot Project or addressed above in Table 2.3.3e, follow the land allocations and standards and guidelines set forth in Alternative S2, as for other regions of the Sierra Nevada.

For purposes of effects analysis in this SEIS, it is assumed that after completion of the pilot project, vegetation and fuels management activities on the Plumas and Lassen National Forests and the Sierraville Ranger District of the Tahoe National Forest would be guided by the direction prescribed for Alternative S2 for the other Sierra Nevada national forests. The future forest plan amendment/revisions required by the HFQLG Act may, however, eventually modify that direction.

The standards and guidelines for fuels and vegetation management for the pilot project are shown in Table 2.3.3e. This table includes the direction for designing and implementing fuels and vegetation management activities within the various land allocations of the HFQLG Pilot Project Area for the life of the pilot project.

Table 2.3.3e. Alternative S2 Standards and Guidelines Applicable to the HFQLG Pilot Project Area.

HFQLG Land Allocation	**Standards and Guidelines**
Offbase and deferred areas	The following HFQLG resource management activities are prohibited: DFPZ construction, group selection, individual tree selection, all road building, all timber harvesting activities, and any riparian management that involves road construction or timber harvesting.
Late successional old growth (LSOG) rank 4 and 5	Group selection and individual tree selection are not allowed in LSOG 4 and 5 stands. DFPZ construction is allowed in LSOG 4 and 5 stands. Design DFPZs to avoid old forest stands (CWHR classes 5M, 5D, 6) within this allocation.
California spotted owl PACs	The following resource management activities - DFPZs, group selection, individual tree selection, and riparian restoration projects and other timber harvesting - are not allowed within spotted owl PACs.
California spotted owl habitat areas (SOHAs)	The following resource management activities - DFPZs, group selection, individual tree selection, and riparian restoration projects and other timber harvesting - are not allowed within spotted owl SOHAs.
National forest lands outside of the above allocations and available for vegetation and fuels management activities specified in the HFQLG Act	**DFPZs**
	<u>Eastside pine types and all other CWHR 4M and 4D classes:</u> ▪ Design projects to retain at least 30% of existing basal area, generally comprised of the largest trees. ▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable. ▪ For CHWR 4M and 4D classes that are not eastside pine types, retain, where available, 5% of total post-treatment canopy cover in lower layers comprised of trees 6 - 24-inches dbh. ▪ No other canopy cover requirements apply.

HFQLG Land Allocation	Standards and Guidelines
	CWHR 5M, 5D, and 6 classes except those referenced above: ▪ Design projects to retain a minimum of 40% canopy cover. ▪ Design projects to avoid reducing pre-treatment canopy cover by more than 30%. ▪ Design projects to retain at least 40% of existing basal area, generally comprised of the largest trees. ▪ Design projects to retain, where available, 5% of total post-treatment canopy cover in lower layers comprised of trees 6-24 inches dbh. ▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.
	All other CWHR class stands: ▪ Retain all live trees ≥30 inches dbh, except to allow for operations. Minimize operations impacts to ≥30-inch trees as much as practicable.
	Group selection
	Design projects to retain all live trees ≥30 inches dbh, except allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.
	Area thinning (individual tree selection)
	All eastside pine types: ▪ Design projects to retain at least 30% of existing basal area, generally comprised of the largest trees ▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable. ▪ Canopy cover change is not restricted.
	CWHR classes 4D, 4M, 5D, 5M and 6 (except eastside pine type): ▪ Where vegetative conditions permit, design projects to retain ≥50% canopy cover after treatment averaged within the treatment unit, except where site-specific project objectives cannot be met. Where 50 percent canopy cover retention cannot be met as described above, design projects to retain a minimum of 40% canopy cover averaged within the treatment unit. ▪ Design projects to avoid reducing canopy cover by more than 30% from pre-treatment levels. ▪ Design projects to retain at least 40% of the existing basal area, generally comprised of the largest trees. ▪ Design projects to retain, where available, 5% of total post-treatment canopy cover in lower layers comprised of trees 6-24 inches dbh. ▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.
	Down wood and snags
	▪ Determine retention levels of down woody material on an individual project basis. Within westside vegetation types, generally retain an average over the treatment unit of 10-15 tons of large down wood per acre. Within eastside vegetation types, generally retain an average of three large down logs per acre. Emphasize retention of wood that is in the earliest stages of decay. Consider the effects of follow-up prescribed fire in achieving desired retention levels of down wood. ▪ Determine snag retention levels on an individual project basis. Design projects to sustain across a landscape a generally continuous supply of snags and live decadent trees suitable for cavity nesting wildlife. Retain some mid and large diameter live trees that are currently in decline, have substantial wood defect, or have desirable characteristics (teakettle branches, large diameter broken top, large cavities in the bole) to serve as future replacement snags and to provide nesting structure. When determining snag retention levels, consider land allocation, desired condition, landscape position, and site conditions (such as

HFQLG Land Allocation	Standards and Guidelines
	riparian areas and ridge tops), avoiding uniform distribution across large areas. During project-level planning, consider the following guidelines for large-snag retention: In westside mixed conifer and ponderosa pine types, four of the largest snags per acre. ▪ In the red fir forest type, six of the largest snags per acre. ▪ In eastside pine and eastside mixed conifer forest types, three of the largest snags per acre. ▪ In westside hardwood ecosystems, four of the largest snags per acre (hardwood or conifer). ▪ Where standing live hardwood trees lack dead branches, six of the largest snags per acre to supplement wildlife needs for dead material. ▪ Use snags larger than 15 inches dbh to meet this guideline. Snags should be clumped and distributed irregularly across the treatment units. Consider leaving fewer snags strategically located in treatment areas within the WUI and DFPZs. While some snags will be lost due to hazard removal or use of prescribed fire, consider these potential losses during project planning to achieve desired snag retention levels.
	Spotted owl surveys
	▪ Prior to undertaking vegetation treatments in spotted owl habitat having unknown occupancy, conduct surveys in compliance with the Pacific Southwest Region survey direction and protocols, and designate PACs where appropriate according to survey results.

Standards and Guidelines for Sensitive Species and Meadow Ecosystems

Willow Flycatcher

Under Alternative S2, late-season grazing (after August 15) would be allowed only in meadows where willow flycatchers have recently been detected. Managers would have the option to extend the grazing period if a meadow-specific management plan has been developed to protect willow flycatcher habitat. When willow flycatchers are no longer detected at previously occupied sites, managers would assess meadow conditions and take restorative action where necessary.

Definitions of Willow Flycatcher Site Occupancy

This alternative requires maintaining a database that identifies and establishes the distinction between occupied and historically occupied sites. Moreover, these new standards and guidelines include criteria for determining when a site switches between these two categories (Robinson and Stefani 2003):

- **Occupied Willow Flycatcher Site.** A site where willow flycatcher(s) have been observed sometime during the breeding season since 1982. For a site to be designated as an occupied site, it must meet the following criteria:
    - Observation date(s) between 1982 and 2000:
        1. Willow flycatcher observed between 15 June and 1 August;

        OR

        2. Willow flycatcher observed between June 1 - June 14 or August 2 –August 15, unless the willow flycatcher was:

        - Absent during surveys conducted between June 15 and July 15 in the same year
        - Absent during June 15 –July 15 surveys in multiple subsequent years; or
        - Detected at a site that is clearly outside of known habitat requirements.
      - For inclusion as an occupied willow flycatcher site, willow flycatcher(s) must be identified by the *Fitz-bew* song or in-hand examination. Museum skins that are identified as willow flycatchers may also be used if the collection date falls within the range of dates listed above.
      - Nests and egg sets in museum collections infer site occupancy, regardless of collection month and day.
      - All sites where willow flycatchers were identified using these criteria are included in the dataset, unless the site is known to have undergone an extreme site conversion rendering it incapable of supporting willow flycatchers currently and in the future (e.g., wetland conversions or inundation by reservoir).
  - Observation date(s) in 2001 or later:
      - Willow flycatcher site occupancy will be determined based upon the classifications defined in the current standardized protocol.

- **Historically Occupied Willow Flycatcher Site.** A site where occupancy is only known from pre-1982 or one that has been surveyed for at least six years over a 10-year period and consistently found to contain no willow flycatchers during the breeding season. For a site to be designated as historically occupied, it must meet the following criteria:
  - Surveys across a minimum of six separate years during a 10-year period must have been performed (alternatively, surveys may be conducted annually for six years within a six- to 10-year period).
  - Surveys conducted since June 2000 must be in compliance with the current standardized willow flycatcher survey protocol guidelines.
  - If a historically occupied site is determined as occupied, the site is upgraded to occupied status until or unless the site meets the definition of historically occupied again.

  There are five sites in the existing database where survey documentation necessary to determine if the observation meets the criteria for an Occupied Site is missing or incomplete. These sites are assigned to a temporary category of Conditionally Occupied until either they receive one survey cycle or the missing information is discovered and documented, at which time they will either be found to be occupied or they will be dropped from the database. Once these sites are resolved, this category is no longer used.

- **Conditionally Occupied Willow Flycatcher Sites.** A site documented in the willow flycatcher database at the time of the Record of Decision that does not meet the criteria for an Occupied Site or a Historically Occupied Site. For these sites, either the month and day of detection are not known or the date of detection occurs outside after August 15.

Yosemite Toad

Under Alternative S2, livestock would be excluded from habitat occupied by Yosemite toads (standing water and saturated soils) during the breeding and rearing seasons. Where physical exclusion of livestock was impractical, livestock would be excluded from the entire meadow. Exclusion requirements could be waived if a site-specific management plan were developed and included a monitoring component.

Restrictions would apply only to commercial livestock and only in areas where surveys indicate occupancy.

Great Gray Owl

Under Alternative S2, meadows within great gray owl PACS would be managed to maintain herbaceous vegetation at a height commensurate with site capability and habitat needs of prey species.

Species Associated with Old Forests

Alternative S2 includes standards and guidelines that require limited operating periods for vegetative management activities in the vicinity of California spotted owl and northern goshawk nest sites and furbearer den sites.

Meadow Ecosystems

For season-long grazing under Alternative S2, utilization of grass and grass-like plants in meadows having early seral status would be limited to 30% (or minimum 6-inch stubble height). For meadows having late seral status, utilization would be limited to 40% (or minimum 4-inch stubble height). The above utilization standards could be modified if current practices are maintaining range in good to excellent condition.

Riparian Management Objectives

Alternative S2 does not repeat management direction found in other policy or regulation. The riparian conservation objectives of the SNFPA ROD were edited to remove redundant standards and guidelines before they were incorporated into the master set of standards and guidelines for this Alternative (Appendix A).

Adaptive Management and Monitoring Strategy

Adaptive management offers an approach to moving forward when decisions must be made in an environment of uncertainty. Kendall (2001) identifies four sources of uncertainty inherent in most resource management decisions:

- *Structural (or Ecological) Uncertainty* results from competing hypotheses about the nature of the dynamics of the populations, community, or landscape of interest.
- *Environmental Variation* occurs even when the system's structure is agreed upon and is manifested in residual variation (or noise) due to factors that are unaccounted for.
- *Partial Controllability* is when a management decision must be applied indirectly to a system, thereby creating variation in the impact.
- *Partial Observability* of natural systems occurs because assessments of landscape-level conditions and processes must always rely on sampling a subset of the target population, community, habitat, etc.

As suggested by several scientists, the Regional Forester invited Dr. William Kendall to visit the USFS Pacific Southwest Regional Office to discuss his experience in the application of the adaptive management approach to making decisions in the face of uncertainty. The Region hosted Dr. Kendall on September 18, 2003. Invitations were extended to the Interagency Team (IAT) as well. An exchange of questions and ideas helped formulate the adaptive management program adopted by the Region.

Clearly, all uncertainty cannot be eliminated. However, on-going management activities can be structured to "learn by doing" which is the essence of adaptive management (Walters and Holling 1990). The concept extends beyond periodically monitoring ecological responses to ongoing management activities. Adaptive management has sometimes been equated to "experimental management" because policies and decisions are not viewed as final solutions but as hypotheses and opportunities for continued learning.

Several definitions of adaptive management can be found in the literature (Table 2.3.3f). As one author notes, these definitions "stem from vastly different institutional contexts, orientations toward problem-solving, and views of nature and science (Blann and Light, 1999).

Table 2.3.3f. Definitions of Adaptive Management.

Adaptive management is:	**Source**
"…the process of continually adjusting management in response to new information, knowledge, or technologies. Adaptive management recognizes that unknowns and uncertainty exist in the course of achieving any natural resource management goals. ….Adaptive management is ultimately dependent upon the ability of institutions to integrate new information into management decisions and approaches. New information gain and institutional response can be characterized in one of three ways. (1) **Trial and error learning** occurs when information is gained by chance. No structured information acquisition effort exists, but learning does occur. (2) **Passive adaptive management** occurs when new information is gathered in a structured manner, questions are pursued in a linear, sequential manner, and the information is incorporated into decision-making. (3) **Active adaptive management** occurs when new information is pursued through multiple hypothesis testing, with strong reliance on experimentation."	USFS, SNFPA, FEIS Appendix E
"a process which integrates environmental with economic and social understanding a the very beginning of the design process, in a sequence of steps during the design phase and after implementation…Adaptive management explicitly recognizes: ▪ The need for management decisions to examine economic, social and environmental values in an integrated way. ▪ The presence of many, diverse, stakeholders in environmental management issues; and ▪ The uncertainty inherent in environmental processes."	Holling 1978
"a process combining democratic principles, scientific analysis, education, and institutional learning to increase our understanding of ecosystem processes and the consequences of management interventions, and to improve the quality of data upon which decisions must be made."	Ecological Society of America 1996
"…an approach to natural resource policy that embodies a simple imperative: policies are experiments, learn from them. In order to live, we use resources of the world, but we do not understand nature well enough to know how to live harmoniously within environmental limits. Adaptive management takes that uncertainty seriously, treating human interventions in natural systems as experimental probes. Its practitioners take special care with information. First, they are explicit about what they expect, to that they can design methods and apparatus to make measurements. Second, they collect and analyze information so that expectations can be compared with actuality. Finally, they transform comparison into learning – they correct errors, improve their imperfect understanding, and change action and plans."	Lee 1993
"…a formal process entailing problem assessment, study design, implementation, monitoring, evaluation and feedback. Management activities are crafted as experiments to fill critical gaps in knowledge."	B.C. Ministry of Forests

Adaptive management is:	Source
"…a systematic process for continually improving management polices and practices by learning from the outcomes of operational programs. Its most effective form—"active" adaptive management—employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed. The key characteristics of adaptive management include a) acknowledgement of uncertainty about what policy is "best," b) thoughtful selection of policies or practices c) careful implementation of a plan, d) monitoring of the key response indicators, e) analysis of the outcome in consideration of the original objectives, and f) incorporation of the results into future decisions."	Nyberg and Taylor 1995
"…a concerted effort to integrate existing interdisciplinary experience and scientific information into dynamic models that attempt to make predictions about the impacts of alternative policies. …Most often, the knowledge gaps involve biophysical processes and relationships that have defied traditional methods of scientific investigation for various reasons, and most often it becomes apparent in the modeling process, that the quickest, most effective way to fill the gaps would be through focused, large-scale management experiments that directly reveal process impacts at the space-time scales where future management will actually occur."	Walters 1997
"…involves constructing a range of alternative response models (hypotheses) based on existing data, calculating the long-term value of knowing which is correct, and then weighing this long-term value against any short-term costs incurred in finding out which is correct. Active adaptive management involves deliberately perturbing the system to discriminate between alternative models (hypotheses)."	Taylor et.al. (1997)

Elements of adaptive resource management, as described by Kendall (2001) are as follows:

1. **A statement of objectives and constraints**

When completed, the objective(s) should be capable of being represented mathematically using a function and an accompanying set of constraints that balance the concerns of all stakeholders.

2. **A set of management options (hypotheses)**

Ideally, the number of management options should be limited, and all options considered should be meaningful.

3. **An understanding of the structure of the ecological system to be managed**

This is usually accomplished via the development of a set of models of system dynamics along with an associated measure of a model's relative credibility.

4. **A program for monitoring the results of management that informs the next management decision.**

This monitoring program must: a) provide information about the current state of the system and allow for an informed management decision based on predictions from the models under consideration; b) provide information about the new state of the system after the decision is implemented; and c) allow information collected during monitoring to influence the development of new models, as needed, especially when empirical predictive models are based on historical monitoring data.

To address the uncertainties associated with managing resources within complex ecosystems, adaptive management is explicitly incorporated into Alternative S2. Using this approach, the Forest Service will address a range of management issues that are deemed most crucial at this time. These issues are outlined and described below. Details of the scientific approach to be used to address each issue will be developed during the first year after completion of the decision document for this SEIS. The underlying premise of adopting this adaptive management strategy is that careful experimentation through incremental active management will yield valuable information over time that will help to inform whether and how the management direction in Alternative S2 should be changed.

How the SEIS fits into the Adaptive Management Model

Completion of the multi-year planning effort for the Sierra Nevada bioregion represents the beginning of an adaptive management process. Management objectives (Element 1) are set forth conceptually in chapter 1 of the FEIS and further refined in chapter 1 of the SEIS. The quantitative representation of specific management objectives and constraints must be developed in the course of monitoring or during research design. Collectively, SNEP, the CASPO technical report, the FEIS, and the SEIS provide a synthesis of the "best available science" pertaining to the ecosystems of the Sierra Nevada and the associated physical and biological attributes. This extensive collection of research and scientific opinion, along with substantial public input and involvement provided the basis for developing an array of management options (Element 2), characterized in the NEPA process as "alternatives" and described in detail in chapter 2 of the FEIS and SEIS. Some models of system dynamics (Element 3) were developed (using SPECTRUM, etc) to project the effects of various management actions on the quality of habitat available for forest-dependent species and on wildland fire behavior. Although not an exhaustive treatment of potential hypotheses of ecosystem configuration and function, such efforts represent an initial attempt to characterize the dynamics of the ecological systems that will be subject to manipulation. Further conceptual and quantitative modeling will be necessary to set the context for experimentation and adaptive management. A description of the modeling process can be found in Appendix B of the final SEIS. The expected outcomes for each management option (i.e. alternative) are described in the "Environmental Consequences" sections of chapter 4 in the SEIS.

The record of decision (ROD) will identify the approach that the Regional Forester believes will best meet management objectives over the short planning horizon. The management direction contained in the ROD is intended to shift the current trajectory of forest conditions (function, structure, and composition) from conditions reflecting decades of fire suppression to conditions reflecting realignment with more typical fire regimes of the Sierra Nevada. Ultimately, the decision will attempt to strike a balance between the perceived benefit of active management and the risks associated with uncertainty about the response of natural systems to such actions. Outcomes of some management decisions are currently uncertain and this alternative incorporates adaptive management to structure the questions to be addressed and the way in which the necessary learning is to occur. To the extent that the management activities are designed to test the underlying hypotheses and assumptions, the decision serves as a starting point for continual refinement and/or validation. In other words, management direction is set forth with the expectation that it will be "adapted" to new levels of understanding over time. Thus, subsequent shifts in management direction will reflect what has been learned in the intervening years.

To date, there are few examples of scientifically credible large-scale multi-resource monitoring plans that have been developed, implemented, and validated (Noon et al. 1999). Large-scale monitoring efforts were developed and implemented for the Northwest Forest Plan (re: managing late-seral forests and aquatic-riparian ecosystems in the Pacific Northwest). These efforts are newly completed, and in some cases, still in progress. Currently, the ability to learn from these efforts is limited to reviewing their approaches and capitalizing on useful innovations. The U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is a rare example of an ongoing, large-scale multi-resource monitoring effort. It strengths and weaknesses have been assessed in great detail (NRC 1994, 1995), and these assessments provide a valuable insights on how to proceed with meeting similar monitoring objectives. The principles have taken root in an array of resource management endeavors including those associated with CalFed, the Glen Canyon Dam, the B.C and Ontario Ministry of Forests and the Lincoln National Forest to name a few. Nevertheless, application of adaptive management to large, complex resource management problems has relatively few proven results. The execution of such a program has many institutional and scientific challenges. Success will be most likely if the program is well organized and supported, and is implemented realistically through incremental steps.

The intellectual appeal of adaptive management is compelling and fundamentally simple. The idea of "learning while doing" is simple to understand and appears to offer a solution to management issues plagued by uncertainty. In fact, people have practiced what amounts to passive "adaptive management" or trial and error learning in resource management for many years in a variety of different problem contexts such as agriculture, fisheries, and forestry. Unfortunately, difficulties and disagreements tend to arise when discussions move past the conceptual stage. For instance, even among those well-versed in the theory of adaptive management, different answers will be found to the following questions:

- How many management options should be explored and which ones?
- What are the most important management questions to answer and what are the key uncertainties to be addressed?
- Does adaptive management require all activities to be conducted under the auspices of experimental design; must every project be designed as an experiment? If not, what criteria should be used to choose the number, location, and type of projects for more rigorous study?
- What degree of scientific rigor is needed to support meaningful "learning"?
- What outcomes signal a need for change in management direction? Who decides when the change occurs and what it should be?
- What constitutes a negative effect?
- Is a certain level/type of negative effect acceptable? Who decides what this is?

Limited resources, time and personnel dictate that these questions be addressed up-front in the design and commitment to an adaptive management approach. Fundamentally important is a process for identifying the objectives and questions, structuring current understanding of the system, and carefully designing the approach to collecting information. Underlying all of this is the need for a firm commitment to support the effort over the long term.

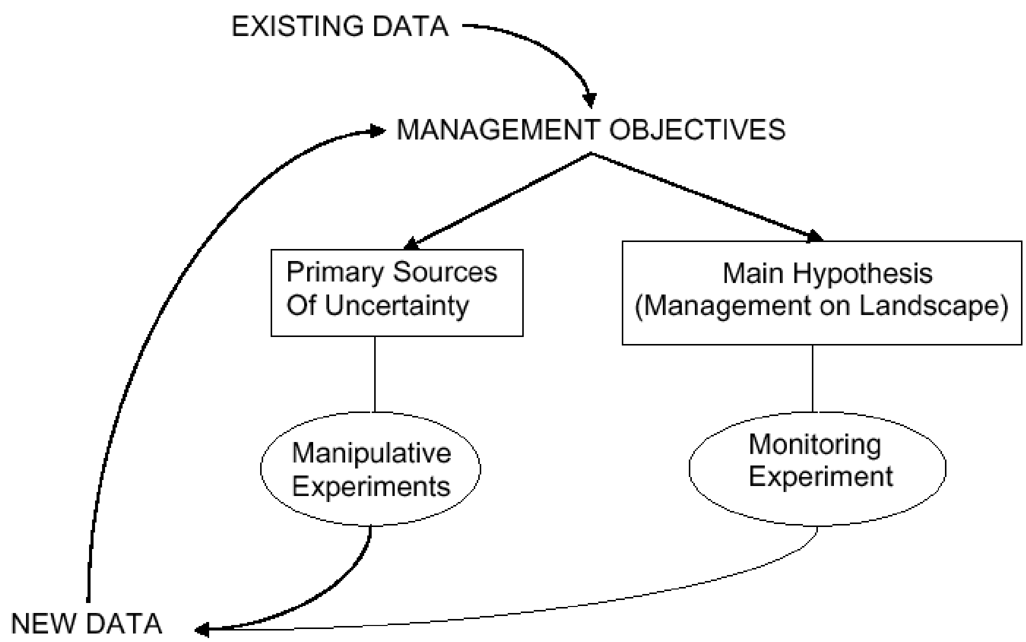
Linking Adaptive Management to the Sierra Nevada Forest Plan Decision

Appendix E of the FEIS provides a comprehensive discussion of the monitoring plan and research priorities to address areas of significant management uncertainty. The monitoring plan included in Appendix E is adopted by reference in Alternative S2. The following section brings forward a number of priority management questions from the aforementioned appendix, describes work already underway to answer them, and provide an outline for additional research. Where additional formal study is needed, opportunities for combining research with forest-level programs of work are identified.

These priority management questions represent the issues deemed most pressing at this time, as judged by the collective input from Forest Service professionals, other interested and involved local, State and Federal agencies, and the public comment. The number and selection of issues can fluctuate at any given time but the issues presented here appear to be the most crucial, particularly in the context of the proposed action. This is done with the expectation that the priorities may adjust over time. Such changes will need to be balanced with the ability and/or the wisdom to conclude ongoing monitoring or research efforts and to add new efforts.

The diagram below illustrates how uncertainty could be addressed through landscape-scale experiments and project level monitoring. Outcomes of experiments and monitoring are cycled back into the review, and possibly revision, of existing management objectives (policy) and direction (procedures).

Figure 2.3.3b. How uncertainty could be addressed through landscape-scale experiments and project level monitoring.



Monitoring and Research Initiatives

A comprehensive adaptive management program involves a strategic combination of different kinds of monitoring and research. All of the information collected for this purpose is assembled, reviewed, and integrated into a feedback loop that informs subsequent management decisions. The building blocks of this program are described below.

Implementation Monitoring

Implementation monitoring tracks whether and how management direction has been followed, including legal requirements and agency policies. The objective of implementation monitoring is to determine the degree to which application of standards and guidelines matches with management direction and intent. Tracking and reporting on implementation of management activities provides a record of accomplishment to the public and documents the extent and distribution of activities conducted by the forests. Managers can compare the results of implementation monitoring (observed actions) with management direction (expected actions) to assess performance. Managers can respond to results of implementation monitoring quickly, and make necessary changes in management through training and improvements in management approaches and prescriptions. Interagency evaluation of activity implementation at the project level can provide an opportunity for collaborative field review of activities authorized by the SEIS. Implementation monitoring is based on the standards and guidelines, as well as existing laws and regulations. Implementation monitoring data will provide information on the level of compliance (e.g., exceeded, met, not met, not capable of meeting) associated with a number of specific questions (FEIS, volume. 4, page. E-13).

Status and Change Monitoring

Status and change monitoring provides a description of the resources, landscape, sociocultural elements, and management activities of focus in this plan amendment. Status and change monitoring provides information on whether desired conditions are achieved as well as providing an early warning of unanticipated impacts from management or other activities. Status and change monitoring consists of (1) *condition monitoring*, which describes important biophysical and sociocultural conditions to gauge if desired conditions are being achieved, and (2) *affector monitoring*, which describes management actions plus biological and physical processes that have the potential to rapidly alter sociocultural processes.

In addition to describing the status and trends in conditions and affectors, this monitoring is intended to describe correlative relationships between affectors and conditions to assist in the identification of potential causal factors for observed changes. However, routine monitoring cannot elucidate cause and effect relationships (FEIS, volume. 4, page E-13).

Each year the Forest Service spends millions of dollars attempting to electronically capture information about planned and accomplished management activities. Some of this information ends up in budget databases as manager's account for the money that is received to complete projects. Other activity tracking information is captured in individual resource databases (i.e. fire, timber or water). Historically, much of this data exists in multiple databases where it has been difficult, if not impossible, to combine or synthesize.

A functional data collection storage and retrieval system is essential to the utility of the implementation monitoring strategy. Ideally, the system would include a spatial component to allow the use of GIS analysis to better understand the relationships among the different types of information being reported. In an effort to centralize activity reporting, the Regional Office has determined that the recently developed, FACTS database will be the main activity tracking system for projects. Beginning in fiscal year 2004, every forest in Region Five will begin using this system. A backlog of historic data will also be entered into the system to provide a baseline for evaluating management activity levels. For example, ten years of silvicultural activity data is being prepped for entry into the system.

Cause and Effect Monitoring and Research

Cause and effect monitoring and research seeks to gain a better understanding of how components, structures and processes respond to management activities, and how ecosystem components interrelate. Cause and effect monitoring and research consists of (1) management effectiveness questions to describe the effect of specific management actions on a desired condition, and (2) validation questions to determine whether assumptions made at any stage of planning or management are sound, particularly assumptions associated with management strategies, desired conditions, and the application of scientific knowledge.

Cause and effect monitoring and research involves testing hypotheses directly related to the effectiveness and underlying bases of management direction and actions. Thus, cause and effect monitoring and research requires careful consideration of the experimental design and analysis of the data to provide meaningful feedback to management. Cause and effect questions were formulated based on key areas of uncertainty and risk associated with management approaches, assumptions, and legal requirements related to the development and implementation of management direction. Cause and effect questions require companion implementation of status and change questions to provide a context for acting on information gained through cause and effect monitoring and research.

Standards and guidelines are a primary focus of cause and effect questions. Standards and guidelines have the force of a legal contract, and will be subject to scientific and legal challenge. But more importantly, the standards and guidelines reflect important assumptions about ecosystem behavior and response. Where there is uncertainty regarding the basis of these assumptions, cause and effect monitoring and research can be applied to reduce uncertainty and lower the risk of unintended negative effects. The level of uncertainty will determine whether the cause and effect question addresses the effectiveness of the standard and guideline as written (uncertainty moderate) or validates the standard and guideline by testing a range of options to determine the most effective approach.

Given that standards and guidelines reflect important assumptions about ecosystem behavior and response, a focus of the adaptive management program will be reducing uncertainty in the weaker assumptions used as a basis for standards and guidelines. The adaptive management strategy is intended to provide greater assurance that key conservation objectives will be met by future management activities (FEIS, volume 4, pages E-13-E-14).

Key Areas of Uncertainty and Priority Management Questions

The Forest Service acknowledges that there are many questions that arise from the scientific uncertainty that inescapably surrounds the key management objectives identified in the SNFPA. The overarching adaptive management strategy detailed in Appendix E of the FEIS describes many of these questions and lays out a detailed outline of a comprehensive strategy. Not everything can be addressed at once. Thus, it is crucial to identify the questions that must and can be addressed first.

Below is a summary of these priorities as viewed today, based on public comments, scientific review, and the collective experiences of Forest Service managers and specialists. The articulation of these questions may evolve as implementation of the adaptive management strategy begins. However, at this time, there is general agreement that these questions capture the essence of the highest priority monitoring and research needs. As the adaptive management program evolves, new work may be identified and adjustments can and will be made, as needed, to respond to the information being collected.

The management questions presented here represent a first step and joining management intent with the feasibility of learning through carefully designed data collection and analysis. The complexity of these issues will require careful iteration of the definition of the precise questions, to be done between the management and policy makers and the technical experts/scientists who will design and execute the work to be done. This initial articulation of the questions is a first step. Over time these discussions will lead to a definition of each question in a manner that will satisfy management concerns and be feasible from a scientific point of view.

Strategies to address management questions are also in various degrees of development and the approaches described below are subject to additional refinement. Under Alternative S2, future investments in monitoring, research, and other efforts to promote learning will be targeted to address the programs and projects described in the following sections.

Wildland Fire

Uncertainties and Management Questions

It is uncertain to what degree high severity wildfires have increased over the past 10 to 25 years. It is uncertain as to the specific location, number, and character of fire and fuel treatments that will be placed in the landscape. It is also uncertain whether fuels treatments, as designed and implemented, will be effective in changing the behavior of fire and the resulting severity and extent of wildfires (FEIS, volume 4, page. E-33). Key management questions include:

1. Do fire and fuel treatments reduce the severity and total extent of wildfires? How does the theoretical Finney strategy (i.e. treating a portion of the landscape) perform when applied on a real landscape?
2. Are the fire and fuel strategies and treatments effective in achieving the desired fire behavior and restoration of the appropriate fire regime within the targeted vegetation types?

3. How effective are fuels treatments (combinations of prescribed burning and mechanical treatments) in realigning fire regimes with self-sustainable conditions of forest function and structure?

Based on the current assessment of information on wildland fire, in addition to a commitment to implementation monitoring, the following initial approach will be used to address the uncertainties surrounding wildland fire.

Efforts to reduce uncertainty about the effects of management activities on the California spotted owl and Pacific fisher will provide a template for testing the effectiveness of the fuels strategy adopted under Alternative S2. A complete set of treatments will be completed over a limited number of landscapes to evaluate effects to species of concerns. The same treated areas will allow testing of the effectiveness of various treatment patterns on fire behavior. To the extent that natural fires overlap with these treated areas, the performance of the fuels reduction strategy can be evaluated before it is applied across the entire bioregion.

Old Forest Habitat and Species

Uncertainties and Management Questions

Old Forest Habitat: The driving uncertainty associated with this issue is if and how the goals of reducing the threat of wildfires can be compatible with the simultaneous objectives of maintaining and restoring the quality and quantity of old forest ecosystems associated habitat values for species-at-risk (California spotted owl, northern goshawk, Pacific fisher, American marten, Sierra Nevada red fox, wolverine). It is uncertain whether unaltered wildfires would have a greater or lesser impact (spatial and temporal) on ecosystem integrity and habitat for these compared to the effects on habitat that will result from proposed fuels treatments. Uncertainty about the implementation and effectiveness of fuel treatments contributes to uncertainty about the level of risk these treatments pose to broader ecosystem goals. Concerns pertain to functional integrity (e.g., nutrient cycling, species diversity, hydrologic function), the quality and quantity of habitat for species-at-risk and the direct impacts to individuals (re: occupancy, reproductive success, or survivorship) (FEIS, volume. 4, page E-34).

California spotted owl: There is uncertainty about how California spotted owl viability in the Sierra Nevada will be affected by the habitat changes projected under Alternative S2. The key concerns stem from: 1) uncertainty about the factors driving current population trends, 2) uncertainty about habitat relationships and habitat quality, 3) uncertainty about the current distribution, amount, and quality of habitat, and 4) uncertainty about treatment effects (e.g., fuels and silvicultural treatments) on habitat and populations at multiple spatial scales (e.g., stand, home range, landscape, forest type). Information suggesting that owl populations are either stable or possibly declining dictates a conservative approach to management and highlights the need to continue to monitor population trends and examine factors that are postulated as potentially responsible (either currently or under future conditions) for population declines, should they be definitively observed and continue. Uncertainty about habitat relationships and habitat quality, or how habitat structure and composition affect survival and reproduction, make it difficult to assess current conditions and project how future scenarios may affect owl populations. Finally, the uncertainty related to the effects of treatments within protected activity centers, home ranges, and across the landscape on habitat and populations render it difficult to evaluate the efficacy of management and conservation efforts to provide for viability (FEIS, volume. 4, pages. E-49-E-50).

Pacific Fisher: Of primary concern regarding fisher viability is the effect of activities that are necessary to address the potential threat of catastrophic fire. Fuels treatments include the goals of reducing the canopy, basal area, and density of trees, snags and logs in selected patches that cumulatively occupy about 30% of the forest area in fire-prone elevations. At particular risk from both wildfire and prescribed fire are the large, rare and slow-to-renew elements of the forest (large diameter trees, snags and logs) that are important denning and resting sites for fishers. Moreover, the loss of canopy closure can increase the depth of snow on the forest floor, which interferes with the movement of fishers (Krohn et al. 1995, 1997).

Salvage and hazard tree removal activities may also reduce numbers of large trees and down logs, potentially degrading habitat suitability (FEIS, volume 4, page. E-53). There is relatively little information about how fishers use their habitat and what the key elements of their habitat are. The extant fisher populations in the Sierra Nevada are at the southern most extent of their geographic range, thus they may actually be utilizing their habitat in ways that are different then what has been observed for fisher elsewhere (e.g. British Columbia, northern Great Lakes, northeastern United States, Canada).

There are many issues regarding old forest species that may deserve to be further investigated. Appendix E of the FEIS details a thorough list of issues that have been identified as important components of the SNFPA adaptive management program. Almost three years later, with some new information available (as identified in this SEIS) and renewed assessment of priorities, there are some questions that have been identified as necessary to pursue initially. Certainly, many other issues will deserve investigation at some future date but the following discussion identifies those issues that require immediate attention.

California Spotted Owl

The adaptive management strategy in the FEIS identified a series of monitoring and research issues that addressed California spotted owls. Given the uncertain status of this taxon and the potential risk of habitat alterations to California spotted owl survival and reproduction, certain monitoring and research activities are deemed immediate needs. Over the last three years, the understanding and appreciation of the vexing management questions related to California spotted owl habitat use has evolved. Questions for which managers need further information can now be more precisely defined. Three basic questions are currently defined as follows:

1. How do individuals and/or pairs of California spotted owls respond to reductions in canopy cover over some portion of their home range core area (HRCA)? Mechanical thinning of forests to reduce fuels hazards will address some ladder fuels and crown fuels in order to reduce the fuels condition class to acceptable conditions. This will reduce the number of trees by some amount (depending on pre-treatment stand conditions) with no trees greater than or equal to 30 inches removed and will reduce crown closure by as much as 30% and down to as low as 40% average within a stand.

   Null hypothesis: Changes in stand structure over some portion of the HRCA (perhaps up to 40% of a 1000 acre HRCA) by reductions of medium sized trees and canopy cover down to 40% has no effect on California spotted owl adult survivorship, reproduction, occupancy, or habitat use.

   Alternative hypothesis: Changes in stand structure over some portion of the HRCA (perhaps up to 40% of a 1000 acre HRCA) by reductions of medium sized trees and canopy cover down to 40% has a differential effect on California spotted owls resulting in lower adult survivorship, reproduction, occupancy, or habitat use.

2. How do individuals and/or pairs of California spotted owls respond to reductions in canopy cover over some portion of their protected activity center (PACs)? Mechanical thinning of forests to reduce fuels hazards may need to enter limited acres of California spotted owl PACs in order to result in effective fuels treatments for a given watershed. Such treatments will address some ladder fuels and crown fuels in order to reduce the fuels condition class to acceptable conditions within a treated area. This will reduce the number of trees by some amount (depending on pre-treatment stand conditions) with no trees greater than 30 inches removed and will reduce crown closure by as much as 30% and down to as low as 40% average within a stand.

Null hypothesis: Changes in stand structure over some portion of the PAC by reductions of medium sized trees and canopy cover down to 40% has no effect on California spotted owl adult survivorship, reproduction, occupancy, or habitat use.

Alternative hypothesis: Changes in stand structure over some portion of the PAC by reductions of medium sized trees and canopy cover down to 40% has a differential effect on California spotted owls resulting in lower adult survivorship, reproduction, occupancy, or habitat use.

3. How do interacting groups or populations of California spotted owls respond to strategically placed area treatments distributed across an entire landscape? This approach represents a fuels treatment strategy that is intended to reduce the intensity and rate of spread (ROS) of wildfires that are inevitably going to happen on Sierran landscapes. These treatments will be a series approximately 100 acre treated stands where surface, ground, ladder, and crown fuels are modified in a manner that is intended to change fire behavior on both the treated lands as well as the remainder of the landscape. Theoretically, treatment of ¼ to 1/3 of the landscape will accrue fuels management benefits to the entire landscape. Thus ¼ to 1/3 of the forest stands within a given landscape will have their structure modified. How will groups of owls in these landscapes (e.g. 10 pairs within a 50,000 acre watershed) respond to these changes in forest conditions?

   Null hypothesis: Changes in stand structure across a landscape resulting from implementation of a network of treatments (100 acre treatments over roughly 26% of a watershed) by reductions of medium sized trees and canopy cover down to 40% has no effect on California spotted owl adult survivorship, reproduction, occupancy, or habitat use.

   Alternative hypothesis: Changes in stand structure across a landscape resulting from implementation of a network of treatments (100-acre treatments over roughly 26% of a watershed) by reductions of medium sized trees and canopy cover down to 40% has a differential effect on California spotted owls resulting in lower adult survivorship, reproduction, occupancy, or habitat use.

Based on the current assessment of information on California spotted owls and the priority questions identified above, under Alternative S2, the following activities will be addressed as the initial program of work to reduce management uncertainties about this species.

A *paired-PAC study (treated/untreated) would be initiated* to test the response of the species to fuels treatment activities in the most sensitive habitat areas. In addition, *landscape-level studies would be designed* to evaluate the response of the species to different degrees of habitat modification at a larger scale. It is anticipated that the latter studies would also provide a template for assessing the effectiveness of the overall fuels strategy over time, depending on the extent to which natural wildfires overlap with treated landscapes. The aforementioned studies would be integrated into ongoing research projects, where possible. However, it is recognized that, depending on the actual study parameters, it might be necessary to redesign work already in process and/or rigorously structure project-level activities to ensure that the desired type and quality of information is obtained.

Pacific Fisher

The adaptive management strategy in the FEIS identified a series of monitoring and research issues that addressed fisher. Given the status of this taxon and the potential risk of habitat alterations to fisher survival and reproduction, certain monitoring and research activities are deemed immediate needs. Accordingly, four issues from the 2001 adaptive management strategy are brought forward here.

1. What is the status and change of the geographic distribution, abundance, reproductive success, and survivorship of the fisher population?

2. What is the near-term effect of the timing, extent, and type of fire and fuel treatments on site occupancy by fisher?
3. What are the habitat relationships of the fisher at the stand, home range, and landscape scales, particularly in relation to den sites? Do existing data on habitat relationships accurately represent habitat of fishers?
4. What are the reproduction and mortality rates of fishers and what environmental features are potentially influential?

Based on the current assessment of information on fisher, under Alternative S2, the following activities will be addressed as the initial program of work to reduce management uncertainties about this species.

The regionwide status and change monitoring efforts for fisher would be sustained. This regional status and trend monitoring described in the adaptive management strategy of the SNFPA FEIS has been implemented during the past 2 field seasons (FY 02 and 03). The first complete sample of the fisher population monitoring program will be completed during mid-November 2003. The ongoing monitoring program is indispensable because it provides the best information on the most important barometer of fisher population health in the Sierra: its distribution. As the fisher distribution increases and is restored to its former range, it will be easier to consider a variety of forest management options. The results of the last 2 years of monitoring indicate that fishers are well distributed on the Sequoia and Sierra National Forests. In fact, comparing the recent distribution of detections on Sierra NF to those from about 6 years ago one could be tempted to conclude that the number of sites with detections is increasing. Should the population expand northward, continued monitoring will allow documentation of the expansion of the species' range into the Stanislaus National Forest and northward. This program is essential to updating the existing state of knowledge regarding the fisher's distribution and, as a result, determining whether management actions are either fostering the expansion of fishers in the Sierra Nevada, or at least not reducing the area of the occupied range. This status and change monitoring program will be continued in 2005 and beyond, until it can be determined that the fisher has recolonized suitable habitat within its historical range.

Analysis and publication of specific active research efforts that support adaptive management would be supported. A number of ongoing research efforts will result in products that can help managers evaluate the effects of vegetation management on the habitat of fishers. These include models that have been developed from field data and that can be used to estimate fisher habitat value at a number of spatial scales. These models can be used to evaluate how changes in vegetation structure, at the plot and the landscape pixel scale, affect the predicted suitability. Thus, they can be used to evaluate changes that occur on the ground or can be used to evaluate simulated changes in stands or landscapes. These tools will be valuable in addressing the effect of specific fuels treatments on habitat value as well as evaluating the cumulative effects (in space and time) of vegetation treatments at the level of the watershed to the level of the entire range of the fisher in the Sierra Nevada. Properly applied, these models will be invaluable aids to the analysis required in Biological Evaluations and for the revision of Land Management Plans.

The papers that require additional support to speed their completion include:

Campbell, L. A. In prep. Habitat associations of carnivores in the central and southern Sierra Nevada. Ph.D. dissertation, University of California, Davis.

Mazzoni, A.K., K.L. Purcell, B.B. Boroski, and D.E. Grubbs. In prep. Resting habitat of fishers (Martes pennanti) in the southern Sierra Nevada. Intended outlet: Journal of Wildlife Management.

Truex, R. L. In prep. Landscape habitat suitability for fishers (*Martes pennanti*) in the southern Sierra Nevada of California. Ph.D. dissertation, University of California, Berkeley.

Truex, R. L., W. J. Zielinski, and F. V. Schlexer. In prep. Short-term effects of fire and fire surrogate treatments on fisher habitat in the Sierra Nevada. Intended outlet: Wildlife Society Bulletin.

Zielinski, W. J., R. L. Truex, J. R. Dunk, and T. Gaman. In prep. Using routinely-collected forest inventory data to estimate and monitor regional changes in the suitability of resting habitat for fishers (Martes pennanti). Intended outlet: Journal of Wildlife Management.

Zielinski, W. J., R. L. Truex, G. Schmidt, R. Schlexer and R. H. Barrett. In prep. Foraging habitat selection by fishers in California. Intended outlet: Journal of Wildlife Management.

The final year of a three-year study of fisher in the Kings River area would be completed (3rd year of 3-year field study through UC Berkeley). In 2004 data will be collected from this population that will be used to estimate population density, survival, and the proportion of females reproducing over the period of 2001 through 2004. Preliminary results on reproduction (based on a limited sample) show that 20 to 83% of captured females had likely reproduced in a given year, with an overall average of 48% of the 29 females captured since 1999 showing signs of having reproduced in the winter/spring prior to capture.

The feasibility of conducting cause and effect monitoring and vital signs research for the fisher would be investigated. The effects of Alternative S2 on fisher habitat are largely unknown, and there is an urgent need to understand the effects of the proposed fuels treatments on fishers and habitat elements important to them. In particular, there is a lack of understanding about the direct effects on the behavior of fishers and on the habitat choices they make when confronted with landscapes that have been modified to reduce the severity of threat to fire. This can only be determined with experiments that involve the animals themselves. Unfortunately, the fisher occurs at naturally low densities and the treatments may affect only a portion of their home range each year. Thus, study areas must be very large to achieve a sufficient sample of animals and the treatments must be applied in a manner regulated by the experimenter. These characteristics suggest that it may not be possible, within realistic budgets, to conduct an experiment that will be able to reject the hypothesis that the treatments have no effects on fishers. The feasibility of this type of experiment must be evaluated. This is not a trival exercise and it will require the time of research scientists and statisticians to evaluate (perhaps via simulation) various study designs. Until this exercise is completed, it is not possible for scientists to recommend the type of experiment that will be successful at determining whether the treatments (the ‘cause’) do not change the probability of fishers persisting and reproducing in treated areas (the ‘effect’).

It is also important to study fisher vital rates (survival and reproduction) in the Sierra Nevada and how they may vary in landscapes with different characterisitics and different levels of fuels treatments. This subject, too, requires a feasibility analysis to determine if sufficient data can be collected to determine whether the treatments have negative, positive or neutral effects on survival and reproductive rates. The feasibility analysis will result in conclusions about the cost and value of conducting studies of vital rates, especially in conjunction with the other monitoring and adaptive management actions that may be implemented on behalf of fishers. If the feasibility studies determine that cause and effect experimentation and vital signs research would have a high probability of success, implementation of a pilot project would be a logical next step.

The Forest Service would actively consult with the California Department of Fish and Game and other partners to explore the feasibility of reintroducing the fisher to the northern Sierra Nevada. Analytical support for this endeavor would be provided by PSW, using existing FIA-based and landscape suitability models to identify potential areas for reintroduction. Comprehensive habitat analysis would precede reintroductions to assure that the animals had a reasonable chance of success.

Aquatic, Riparian, and Meadow Ecosystems

Uncertainties and Management Questions

Yosemite toad: The major area of uncertainty regarding Yosemite toads revolves around habitat conditions and the relationship of disturbance (both natural and human-induced) to meadows to population response. Overall viability of the mountain meadow ecosystems is contingent on a variety of physical and biological factors that are not completely understood. Management activities in mountain meadows have an influence on these factors and thus, can impact populations of this species. One of the particular management issues related to this concern is the effect of proposed livestock grazing standards on habitat conditions. The proposed standards change the timing and intensity of meadow use but these approaches are untested with regard to the population and habitat needs of the Yosemite toad. While eggs and tadpoles are confined to small breeding areas, metamorphs are found throughout meadows, and are thus likely to be more vulnerable to direct mortality from livestock than are eggs and tadpoles. More thorough and targeted scientific information is needed to determine if and how livestock could be compatible with persistence of self-sustaining populations of Yosemite toads.

While research on environmental toxin effects on this species has not yet been conducted, closely related frog and toad species in other regions have shown sensitivity to numerous pesticides, herbicides, and fertilizers (Berrill et. al. 1997, LeBlanc and Bain 1997). Because these chemicals are thought to disrupt endocrine systems in amphibians at low concentrations, application of pesticides and herbicides are considered to be a risk factor for the Yosemite toad. Thus, the extent of use and the effects of increased herbicide use for noxious weed control and silvicultural applications and the interaction of these two uses are a key uncertainty.

There are also several information gaps that create general areas of uncertainty common to this amphibian species. Basic life history (e.g., longevity, fecundity), population dynamics, and metapopulation characteristics are poorly known. Habitat associations are better understood, but research is needed on seasonal and life stage variations in habitat requirements. While there is fairly good qualitative information on the historic and current distributions of the species, a quantitative range-wide analysis of its status is needed (FEIS, volume 4, pages E-91-E-92). This work has been initiated by a regionwide status and trend monitoring program and results are beginning to fill in information gaps.

Again, a subset of the monitoring and research questions originally identified in Appendix E of the FEIS are brought forward here. These are questions that are considered the most crucial issues that need to be addressed, particularly in light of the changes proposed in Alternative S2. These questions include:

1. What are the direct and indirect effects of various livestock grazing practices on Yosemite toads and their habitat?
2. What are the habitat requirements (including biological factors such as introduced fish) of Yosemite toads at multiple scales (local population and subwatershed/meadow complex) and what is needed to maintain or restore the population and genetic structure of these species?

Based on the current assessment of information on the Yosemite toad, under Alternative S2, the following activities would be addressed as the initial program of work to reduce management uncertainties about this species.

Six allotments from the Stanislaus and Sierra National Forest would be selected for an adaptive management study. Stanislaus National Forest allotments may include Long Valley/Eagle Meadow, Herring Creek, Highland Lakes, and Cooper. Sierra National Forest allotments may include Blasingame and Dinkey. The actual allotments selected would be determined in collaboration with forest range specialists, biologists, managers, researchers and the affected permittees. On each allotment, one or more meadows would be selected as controls (total exclusion of grazing) and the remaining meadows would be grazed according to applicable utilization standards. There would be no limited operating period invoked or exclusion of use on the grazed meadows. Attributes to be studies would include distribution, abundance, and demographic characteristics (e.g. reproductive and survival rates); in-stream, pond and meadow characteristics (e.g. measures of hydrologic regimes, water depth, fine and course sediments, water temperature, and meadow vegetation composition and microclimate); and various livestock grazing practices (e.g. grazing utilization, method, duration, and season).

Site-specific management plans would be developed for some allotments where grazing occurs in occupied Yosemite toad habitat. These management plans would be developed by an interdisciplinary team, and include a biological evaluation and a monitoring plan.

Willow flycatcher: Current willow flycatcher populations are estimated to range from 300 to 400 individuals with 120 to 150 individuals on National Forest System lands in the Sierra Nevada (Green et al. 2003). There is uncertainty as to whether all extant populations are known. It is estimated that only approximately 60-70 percent of currently occupied willow flycatcher sites have been identified. Thus, there is some risk of impact to willow flycatchers from management activities because managers are unaware of the species' presence. Furthermore, restoration of suitable habitat to increase the population requires a more thorough understanding of the limiting factors that influence population performance. Influences to and condition of overall montane meadow ecosystems are poorly understood. Impacts from livestock to vegetation, hydrology, and stream banks (and thus indirectly to willow flycatchers) are among the management activities that create uncertainty. It is unclear whether grazing and recreation standards and guidelines will reduce the threat of cowbird parasitism. Potential grazing impacts in occupied willow flycatcher habitat after the breeding season may reduce habitat suitability in subsequent years. Finally, uncertainty remains as to whether potential grazing impacts outside of occupied habitat will allow flycatchers to expand into new areas (FEIS, volume 4, page E-94).

Again, a subset of the monitoring and research questions originally identified in Appendix E of the FEIS are brought forward here. These are questions that are considered the most crucial issues that need to be addressed, particularly in light of the changes proposed in Alternative S2. These questions include:

1. What are the habitat characteristics of the willow flycatcher at the local, territory, and landscape scale and how do they relate to abundance and reproductive success?
2. What are the direct and indirect effects of various livestock grazing practices on willow flycatchers and their habitat?

Based on the current assessment of information on the willow flycatcher, under Alternative S2, the following activities would be addressed as the initial program of work to reduce management uncertainties about this species.

The Regional Office would develop a conservation strategy for willow flycatchers in the Sierra Nevada. This conservation strategy would be informed by information contained in the recently completed Willow Flycatcher Conservation Assessment (Green et al. 2003) and include specific management recommendations for such issues as meadow condition, monitoring, nest predation, habitat restoration, and cowbird paratism. The conservation strategy would be an interagency product, incorporating input from the state of California as well as the U.S. Fish and Wildlife Service. Once completed, a conservation agreement would be utilized to apply the conservation strategy throughout the range of the willow flycatcher in the Sierra Nevada.

Site-specific management plans would be developed for some allotments where grazing occurs in occupied willow flycatcher habitat. These management plans will be developed by an interdisciplinary team, and include a biological evaluation and a monitoring plan.

Meadow condition: It is uncertain whether the combination of proposed management activities will be effective in moving meadows toward desired conditions. It also uncertain whether livestock grazing policies result in improved meadow condition and whether other policies would be more effective (FEIS, volume 4, page E-83). The Science Consistency Review for this planning effort noted that meadows are extremely complex ecosystems consisting of numerous interacting variables. Further study and the development of additional knowledge about the complex workings of these systems is warranted.

Given the ecological value of montane meadows to a suite of species a more holistic approach to examination of meadow health is warranted. In the 2002 FEIS Adaptive Management strategy the key question identified was:

- What livestock grazing standards are most effective in maintaining and restoring physical, chemical, and biological conditions in stream, riparian, and meadow ecosystems?

Based on the current assessment of information on meadow condition, under Alternative S2, the following activities would be addressed as the initial program of work to reduce management uncertainties.

The regionwide program of status and change monitoring for meadows will be reviewed and evaluated to ensure inclusion of the appropriate set of elements. Given the range of issues surrounding the ecological condition of montane meadows, the general issue should be addressed as well, or in combination with more specific questions regarding effects of grazing on montane meadows. There is a need to bolster understanding about how meadows function, how hydrologic regimes influence primary productivity, and how fluctuations in weather patterns factor into these issues. Sierra meadows are extremely important to birds, and avian monitoring can provide feedback from a whole suite of organisms within a system making birds a cost-effective, practical alternative for eliciting the necessary feedback of the effects of meadow management. Therefore, a rangewide, multi-taxa monitoring plan for mountain meadows is an important step towards addressing the health of montane meadows. Other aspects of meadow ecology such as hydrological regimes, sedimentation, and vegetation succession should be incorporated into the overall design of montane meadow monitoring.

Ongoing Monitoring and Research Relevant to this Adaptive Management Program

There are a number on ongoing monitoring and research activities that touch on part of the anticipated needs described in the SNFPA adaptive management program. Some of this work is being executed by the Pacific Southwest Research Station of the Forest Service, some is being done or funded by the Regional Office, and some is being done by various academic and other research institutions. A successful adaptive management program of the scope and complexity as that contemplated here will require contributions from many different sources. Coordination, collaboration, and effective communication will need to work if the expectations of this program are to be realized.

Below, is a summary of some of the key ongoing activities that will make meaningful contributions to the overall goals of adaptive management in the Sierra Nevada. Further collaboration and coordination will need to be executed in the subsequent execution of monitoring and research done in the Sierra. The design, objectives and implementation of the following projects may be reviewed and adjusted to better address the key management questions identified in the previous section.

Owl Demographic Studies

There are four ongoing California spotted owl demography studies within the Sierra Nevada bioregion:

- Lassen national forest, 1300 km2 study area (1990-present)
- Eldorado National Forest, 355 km2 study area (1986-present)
- Sierra National Forest, 417 km2 and a 267 km2 study areas (1990 and 1994-present)
- Sequoia and Kings Canyon National Parks, 337 km2 (1990-present)

Another demographic study was conducted on the San Bernadino National Forest from 1987-1998.

Collaborators involved in this long term work include the Dr. Rocky Gutierrez and Mark Seamans from the University of Minnesota (El Dorado study area) , Dr.s Barry Noon and Jennifer Blakesley from Colorado State University (Lassen study area), and researchers at the Pacific Southwest Research Station of the Forest Service (Sierra and Sequoia study areas).

Study objectives vary slightly but generally include all or most of the following:

1. Estimate densities of spotted owls and occupancy status of owl territories in the designated study area;
2. Estimate demographic parameters (survival rates by age and sex, nesting, nest success, productivity and fecundity rates, the rate of change of the population size, and the population structure;
3. Assess the site fidelity of individual owls;
4. Estimate the number of missing and replaced owls;
5. Quantify the distribution of habitats within the study areas (Sierra/Sequoia studies only);
6. Characterize the diets of owls from regurgitated pellets and compare diets of breeding and nonbreeding pairs during the breeding period (Sierra/Sequoia studies only).

The data from the five demographic studies were analyzed in a meta-analysis conducted by spotted owl biologists in conjunction with scientists in expertise in population biology, statistics, and data analysis (Franklin et. al. 2003). The data from the demographic studies comprise the only empirical information on California spotted owl population trends, survival, and reproduction over the past 7-12 years. As recommended in the meta-analysis report, the demographic studies provide a valuable opportunity to conduct adaptive management experiments because of the rich set of baseline data that exists. The authors of the report provide the following recommendations:

a. Develop comprehensive, accurate vegetation maps on the demographic study areas in order to evaluate the influence of landscape habitat characteristics on variation and trends in demographic parameters;
b. Coordinate the existing demographic studies with forest management activities to develop quasi-experiments on the effects of these activities on demographic parameters; and
c. Design landscape-scale experiments to assess the effects of silvicultural treatments designed to reduce fire risks and the owl’s response to controlled logging and silvicultural treatments.

Currently, the demographic studies do not directly address any of the priority management questions. However, they do provide an unparalleled baseline from which to begin research on some of the causal aspects of California spotted owl behavior. A study of the effects of habitat change on demographic parameters would be consistent with the priority management questions identified above. Because the Lassen study area is part of the HFQLG pilot project area and the Sierra National Forest study area overlaps with the King River administrative study (see below), the Eldorado National Forest study area is a prime candidate for studying the effects of management activities on the species. The baseline population and reproductive history are well-documented and the study area is of a size that will allow the fuels strategy to be tested at a fireshed scale. Depending on required sample sizes and replicate sites required to reach statistically valid conclusions, it may be possible to address some of the priority management questions with one or two carefully designed experiments conducted inside the pre-existing study area.

Kings River Project

The Kings River Project was developed from the consolidation of the Kings River Administrative Study and ongoing PSW research studies. The project area is large enough (approximately 131,500 acres within the Dinkey Creek and Big Creek watersheds of the Kings River drainage on the Sierra National Forest) to allow replication of experiments and represents the heterogeneity of southern Sierra ecosystem types. Research study areas range in size from very localized small plots to small watersheds and landscapes depending on the species or process being studied. Small mammal plots are only five acres in size, forest bird study plots are 99 acres, experimental watersheds are 120-560 acres, and owl pair study areas will be 1,000 acres.

The overall purpose of the Kings River Project is to evaluate the response of forest ecosystems to a management strategy consisting of a specific uneven-aged silviculture and prescribed fire program. The nature of this program has been defined by the management team from the Sierra National Forest in consultation with scientists at PSW. There are several study components: the uneven-aged management strategy, the Kings River Experimental Watershed, California spotted owl, fisher, forest birds, and air quality. Some of these components are ongoing, long-term research, while others are newer (such as air quality). In addition to PSW research and case studies, there will be forest monitoring of effects.

The purpose of the uneven-aged management strategy is to determine if the planned vegetation treatments result in a historic forest structure and composition thought to dominate the western Sierra Nevada before the advent of European influences. The forested portion of the Kings River Project has been divided into 80 management units. Over approximately the first 35 years, all of the management units would potentially have projects planned to change the vegetation by applying the uneven-aged management strategy and by periodically underburning.

Specific questions for 25 and 50 years after the initial application of the uneven-aged management strategy and the initial underburning between treated and untreated management units include:

a. What is the difference in tree age, species and size distribution?
b. What is the difference in canopy cover of medium (20-34.9” dbh) and large trees (>35” dbh)?
c. What is the change in total basal area?
d. What are practical considerations, limitations and costs of implementing the Uneven-aged Management Strategy?

For the aquatic systems, the Kings River Experimental Watershed (KREW) is a study within the Kings River Project led by research scientists at PSW. The intention of the KREW is to be as holistic and integrated as possible with a focus on headwater stream ecosystems and their associated watersheds. The KREW study is designed as a long-term study with 15-year minimum period of study that started in the year 2000. The main goals of KREW are to quantify the existing condition and variability in the characteristics of headwater stream ecosystems and their associated watersheds. Selected measurements for evaluation include nutrient budgets, sediment budgets, stream food web and/or energy budget, geological and geomorphic processes, and vegetation and fuel loading characteristics.

The Kings River experimental watershed study addresses:

a. What is the effect of fire and fuels reduction treatments (i.e. thinning of trees) on the riparian and stream physical, chemical, and biological conditions?
b. Does the use of prescribed fire increase or decrease the rate of erosion (long term versus short term) and affect soil health and productivity?
c. How adequate and effective are current stream buffers at protecting aquatic ecosystems?

Several PSW wildlife studies are also ongoing or planned to address the following questions:

a. What are the short-term responses of fishers, owls, and other sensitive species to the treatments?

b. Do sensitive species populations increase, decrease or remain stable in response to treatments and in comparison to no treatments?

c. What are the trends in the distribution and abundance of fishers, owls and other sensitive species after 10, 20, and 50 years?

Six owl territories (four active and two inactive) have been selected for treatment in the first five years of the project. More territories will be selected for study, as the project moves forward with additional treatments.

Plumas/Lassen Case Study

The impetus for this work comes from the Records of Decision (RODs) for both the Sierra Nevada Forest Plan Amendment (SNFPA) and the Herger-Feinstein Quincy Library Group (HFQLG) Forest Recovery Act Pilot Project. The HFQLG pilot project was initiated under the HFQLG Forest Recovery Act to demonstrate how a strategy of defensible fuel profile zones (DFPZs), group selection, individual tree selection, avoidance or protection of sensitive areas, and riparian restoration could be used to promote healthy forests that provide both suitable habitat conditions for an array of wildlife species as well as a sustainable local economy.

The complexity of the original experiment-driven approach became unwieldy for managers to handle. As a result, the decision was made to drop efforts to develop a purposefully crafted landscape experiment where treatments were to be specifically placed in space and time to test response over entire landscapes. The redesigned study currently allows for treatments to be planned and implemented with the sole purpose of implementation of the HFQLG Pilot Project on the schedule anticipated for this program. Placement, size, intensity, and timing of vegetation management projects (i.e. fuels management and silviculture) will be dictated by the Pilot Project. Thus, there is no way to specifically direct the location, size, intensity, or timing of projects in order to facilitate an experimental design. However, the proposed research program is still designed to address key management questions, albeit through a more passive adaptive management approach.

The study has been subdivided into sub-components, or modules. Two of these are particularly relevant to the focus of this discussion and are highlighted below.

Fuels, Fire Behavior, and Fire Effects Module

The goal of this study module is to determine how landscape level fuels and silvicultural treatments affect potential fire behavior and effects. Data will be used to characterize fuels, forest structure, and fire behavior and effects prior to and after landscape fuel treatments. Study methods include remote sensing, extensive field sampling, and fire behavior and effects modeling. The primary questions are:

1. How do current fuels conditions affect potential fire behavior and effects?
    - What are current fuel loads and ladder fuel conditions prior to treatment?
    - What is the range of potential fire behavior given current conditions?
    - What are likely effects of fire behavior on these landscapes as determined by simulation models?
2. How will fuels treatments (i.e. DFPZs and other management applications) change fire behavior and effects?
    - How do defensible fuel profile zones (DFPZs) affect fuel loading?

- How does the placement of DFPZs affect potential fire behavior? Do they reduce the risk of catastrophic fire under extreme weather conditions?
- What effect would DFPZs have on resulting fire effects? Would the reduction in total fire extent and intensity reduce the severity and extent of canopy fires?
- And, in the very long-term, how do strategically places area treatments affect fuel loads and potential fire behavior?

California Spotted Owl Response Module

This module is designed to provide information on treatment effects at the individual site and population level scales. The following four questions will be addressed:

1. How are landscape-scale fuels treatments associated with California spotted owl density, distribution, population trends and habitat suitability at the landscape-scale?
   - The goal is to assess treatment effects on owl populations and their habitat within a habitat-modeling framework designed to improve understanding of wildlife habitat relationships and provide land managers with a tool to predict the effects of management actions on owls and their habitat. The study design will provide a general framework that can be responsive to changes in management objectives over time as management priorities evolve in response to changing ecological, societal or economic goals.
2. How are landscape fuels treatments associated with California spotted owl occupancy, diet, reproduction, and survival, and habitat fitness potential at the nest site, core area and home range scales?
   - The objectives at the home-range scale are: (1) determine owl habitat-use patterns and habitat selection; and (2) determine if there are differences in habitat quality or habitat fitness potential (i.e., owl survival and reproduction) associated with variation in habitat patterns. Each of the above questions will be assessed hierarchically at the nest-site, core area, and home-range scales within each owl home-range, as stronger associations between owl occurrence, demographic responses and habitat occur at the nest-site and core areas spatial scales within home ranges (Lehmkuhl and Raphael 1993, North et al. 2000, Franklin et al. 2000).
3. How are landscape-scale fuels treatments associated with California spotted owl habitat use, home range configuration, and habitat suitability at the nest site, core area and home range scales?
   - The objectives of this question are to determine behavioral responses and home range configuration, habitat use, and prey use patterns of a subset of owl pairs to treatments within core areas of home ranges. Radio-telemetry will be used to quantify habitat use, home range configuration, and habitat suitability pre- and post-treatment on a subset of CSO pairs that occur in areas that will be treated. Sampling will be opportunistic in response to where the Forests will be conducting treatments following the protocol for assessing treatment effects proposed by McDonald and McDonald (2002). The information generated to meet the objectives of this question will complement the information generated under Questions 1 and 2 listed above by providing finer-scale resolution data on the response of owls to treatments.

The Region has provided funds to conduct the Plumas/Lassen case study. The Pacific Southwest Research Station is matching this funding to execute a total of five modules that are part of this integrated research project. The additional related modules include examination of small mammal habitat associations, vegetation response to fuels treatments, and landbird response to treatments integrated across the landscape. An important consideration is that the focus of this work is on testing and understanding the effects of an entirely different strategy for altering wildland fire behavior than is envisioned for the rest of the Sierra Nevada and for the HFQLG pilot project area after the pilot project is completed. For this competing strategy, all priority management questions for fire and the California spotted owl are addressed, albeit not in the context of a rigorous experimental design. However, the study does not contribute to learning about the effectiveness of the proposed fuels strategy (using strategically placed area treatments) or the effects of the strategy on the California spotted owl at a landscape scale. Nevertheless, some project-level questions about canopy closure and the relative significance of other habitat attributes can be addressed.

Status and Change Monitoring

Fisher & Marten Monitoring

The regional status and trend monitoring described in the adaptive management strategy of the SNFPA FEIS has been implemented during the past 2 field seasons (FY 02 and 03). The first complete sample of the fisher population monitoring program will be completed during mid-November 2003. Marten monitoring has involved completing assessment of the status of marten distribution in 2002, and full population monitoring during 2003.

Habitat monitoring is in development and will rely on a combination of FIA data, plot level vegetation data collected at population monitoring survey locations, and landscape models. The ongoing monitoring program is indispensable because it provides us the best information on the most important barometer of fisher population health in the Sierra: its distribution. As the fisher distribution increases and is restored to its former range, it will be easier to consider a variety of forest management options.

The results of the last 2 years of monitoring indicate that fishers are well distributed on the Sequoia and Sierra National Forests. In fact, comparing the recent distribution of detections on Sierra NF to those from about 6 years ago one could be tempted to conclude that the number of sites with detections is increasing. Should the population expand northward, continued monitoring will allow us to document expansion of the range into Stanislaus NF and north. This program is essential to updating our state of knowledge regarding the fisher's distribution and, as a result, determining whether management actions are either fostering the expansion of fishers in the Sierra Nevada, or at least not reducing the area of the occupied range.

Soil Productivity Monitoring

The need for Status and Change soil monitoring was evident when the FEIS was written and no quantified data about existing soil conditions over the Sierra Nevada region was available. It was therefore necessary to use a qualitative risk assessment to estimate the possible effects on soil productivity from implementing the chosen alternative (USDA Forest Service 2001, Sierra Nevada Forest Plan Amendment FEIS). The lack of knowledge regarding current soil condition and inability to quantitatively predict management effects creates a high level of uncertainty if the qualitative risk assessment accurately predicted potential effects on soil productivity.

Major management related effects, or affecters, which could reduce soil productivity, include the use of mechanical fuel treatments; prescribed burning, grazing, and OHV use. The soil quality standards (SQS) (see Sierra Nevada Forest Plan Amendment FEIS, Appendix F) define measurable soil properties to be used as indicators of soil health.

There has been no previous effort by Region 5 to monitor soil condition over large areas such as the Sierra Nevada. This study plan represents the first attempt to conduct status and change soil monitoring for the Sierra Nevada range.

A Soil Scientist was hired in August of 2003 to oversee the monitoring effort. Several Soil Scientists on Forests throughout the Sierra Nevada reviewed the draft study plan in July of 2003. The following decisions were made to proceed with the study plan completion.

FIA protocols and personnel will be utilized to collect data for consistency.

The Sierra Nevada will be stratified so that more samples would be gathered in zones of intensive management but other zones would also be monitored.

FIA protocols under Phase I and II that could provide useful information about soil condition would be utilized and other protocols would be developed that could be added on to the FIA procedures. The qualitative monitoring protocols would require less time to perform and would increase the number and frequency of observations and yet keep costs within budget.

Several of the same Soil Scientists are still to finalize the stratification and use of qualitative descriptors to provide a greater number of observations. Visual and qualitative classes of soil disturbance would be developed to identify soil displacement, indications of probable compaction and soil cover levels. It is anticipated that monitoring would start this coming field season.

Air Quality Monitoring

The Sierra Nevada is adjacent to some of the most severely degraded air quality in the nation. The San Joaquin and Sacramento Valley emissions impact terrestrial, aquatic, and visibility resources. Ozone concentrations are historically high and some Sierra vegetation exhibits injury that is likely pre-disposing it to more widespread insect, disease, and drought mortality. Sierra lakes are in the most chemically dilute (lowest capability of neutralizing acidic inputs) group in the U.S. making them extremely sensitive to acidification. Contribution of emissions from prescribed burning in forest treatments is being questioned by air quality regulatory agencies.

The Smoke Monitoring Plan developed in the Framework is a mechanism to develop data to support informed management and regulatory decisions. The small budgeted amount is largely used to facilitate other efforts in the Sierra that capitalize on very large well- funded assessments.

EPA relies on recommendations from the Forest Service in the issuance of permits to proposed facilities with significant emissions. The ozone and surface water project monitoring is currently allowing a credible response.

The Lake Monitoring Plan has had synoptic surveys completed in 7 of the 10 Class I areas in the study area. Lakes have been selected in those areas and 2 years of sampling has been completed by Forest staff.

The Ambient Ozone and Ozone Effects of Vegetation Study Plan was the basis for collaboration with California Air Resources Board (CARB) in 2001 to examine ozone transport in major drainages to the eastern Sierra. The Ambient Ozone and Ozone Effects of Vegetation Study Plan was critical in securing collaboration with CARB and EPA in continuing evaluation of pine plots throughout the Sierra from the Sequoia to Lassen.

A contract has been awarded to provide instrumentation and service near sensitive communities. This will include near real-time satellite data delivered to a web site providing assistance in management decisions. The Sierra and Stanislaus National Forests will deploy a limited number of instruments and will join in on the data service contract in 2004.

Meadow Monitoring

The proper ecological functioning of meadows ties to the viability of species dependent on meadow ecosystems. Vegetation condition provides information that addresses habitat needs of a suite of animal species. Study results will be used to determine whether the Sierra Nevada Forests are achieving desired conditions and to gather baseline data on meadow condition. The data can be used to develop the baseline necessary for cause and effect monitoring.

Meadows have been selected randomly across the entire bioregion. Sample sites include grazed and ungrazed meadows. Selected meadows have different intensities of grazing and previously grazed meadows have been released from grazing for varied periods of time. Selected meadows support varied levels of recreational activities that can impact animal populations. Meadow monitoring is designed help explain the distribution of animal species that use meadow ecosystems. The plans for meadow monitoring and amphibian habitat monitoring were designed to compliment each other.

Vegetation Community Monitoring

A goal stated in the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS was that forests with old-growth characteristics increase in both area, distribution, and continuity across national forest landscapes. To that end, the goal of this study plan is to describe the status of the quantity and quality of conifer and hardwood forest ecosystems throughout the SNFPA FEIS area and how they are changing over time. Continued monitoring allows for the only consistent way an evaluation of the current state of desired conditions and an assessment of trends toward or away from those conditions.

Data for status and trend monitoring of forest vegetation has been collected by FIA and contracted field crews for the last 3 field seasons using the majority of protocols outlined in the study plan. These include data on down woody debris and fuels in addition to vegetation. Additional data collected specifically for the study plan was collected over the last 2 field seasons. This data is currently being loaded into the new corporate database and the 2001, 2002, and 2003 data should be available for initial analysis within the next few weeks. In addition to the FIA plots, data from intensification plots designed by the RSL to measure vegetation in rare or unique vegetation types have been measured throughout the SNFPA area with the additional protocols designed for monitoring.

If the planned sampling rate is continued, the initial measurement will be completed by the end of FY 2006. This will produce an assessment of the current state of forest vegetation as it relates to desired conditions by spring of 2007. The analysis will also produce a SNFPA area estimate of fuel levels and their structure. Cause and effect studies related to vegetation and fuels management can be more clearly focused and, therefore, more cost effective using these results.

Landscape Map of Fire

The creation of fire severity maps will allow the assessment of not only how many acres have burned each year, but ***how*** each of those acres burned. Maps start with spatial vegetation data and fuels treatment data followed by the development of fire severity types. This could allow links to treatment methods that will reduce fire severity over the landscape. This type of information could allow the assessment of how well strategically placed treatments are changing fire severity at a landscape scale. It will enhance our ability to assess current fire regimes and compare those to “historical” fire regimes.

The fire monitoring program has been have collected data from 786 plots on USFS land and 143 plots on NPS land covering 13 large fires. This data will be used over the next year to finalize the fire severity maps.

Fire severity will also be mapped for all fires in the last 15 years and the data will be combined with current fires to define current fire regimes for two different Landsat scenes; one containing Lake Tahoe, and the other containing Yosemite National Park and the Stanislaus National Forest and the data will be combined with current fires to define current fire regimes. These areas will provide an immediate model for fire regimes in several vegetation types as well as allow us to better refine our data collection, processing and compilation for the next 8 years with ground verified data.

In FY04 mapping all fires greater than 1000 acres would continue with field data for ground verification of the maps. As discussed above, we will be using the model based on ground data to go backwards in time to create fire regime distributions for several vegetation types.

Amphibian Monitoring - Yosemite Toad and Mountain Yellow-legged Frog

Both the Yosemite toad and the mountain yellow-legged frog are USFWS candidate species (federal listing is warranted). Recent studies and assessments have indicated that these species are in decline. Yosemite toads have disappeared from more than 50% and Mountain yellow-legged frogs from 70-90% of historic localities. USFS management has the potential to contribute to the restoration or continued decline of these species. This monitoring provides essential data on occupancy patterns, the best indicator of population trends for these species. Results represent the entire range of the species which is the appropriate scale to assess their health and could determine whether the Forest Service is meeting desired conditions for Yosemite toad and mountain yellow-legged frog populations and habitat throughout their range in the Sierra Nevada.

The amphibian monitoring occurs in a random selection of small basins (3-4 km2 in size) to determine the status and trend of population (occupancy) and habitat for each species. 211 study basins throughout the species range were selected for monitoring. Basin size was reduced in 2003 after analysis of 2002 data. For efficiency, the study plans for the two species were integrated into one program with the same design and protocols. Sample basins are visited once in a 5-year monitoring cycle with 20% revisited annually. Population is measured by breeding occupancy (number of basins occupied by tadpoles or egg masses, number of breeding sites per basin) and relative abundance and demography in select basins. Habitat is measured by various attributes that assess 1) Hydrologic condition, 2) Habitat matrix, 3) Cover, 4) Water temperature, 5) Level of disturbance, and 6) General characterization of the habitat. A relational database in MS Access was developed for data storage.

Two years of occupancy and habitat data have been collected in basins distributed throughout the range of the species providing information on the Sierra-wide population. Both species have been found in a wider variety of habitats than initially expected. Meadows may be more important for the Mountain yellow-legged frog than initially expected. Both species have been found in slow-moving meadow streams. Both species have been found in the basins expected based on the study design.

Implementation of the Adaptive Management Strategy

Full development of the strategy will entail a number of steps, including, (1) identifying the most effective specific metrics for selected attributes, (2) determining the experimental design and sampling protocols, (3) determining sample size requirements to achieve desired levels of confidence and statistical power, (4) description of data analysis and evaluation techniques, (5) identification of management "checkpoints" that indicate the need for review or the achievement of a goal, (6) development of data bases and information management and sharing strategies, and (7) institutional response and collaboration mechanisms.

The following criteria will guide further refinement (i.e., design and implementation) of the adaptive management strategy:

- **Cost efficiency** - getting the most information for the least cost should be a high priority;
- **High yield of useful information** - information is useful for as many applications and across as broad a range of spatial scales as possible;
- **Engagement of management leadership** - the leadership and the staff of the Region need to be directly engaged in the process of implementation as possible to facilitate ownership, education, and timely application of information to management direction;

- **Quality control** - data collection and management should be designed so that quality control standards are applied evenly and effectively across all data collection points and efforts;
- **Scientific defensibility and credibility** - designs for data collection, quality control efforts, and data analysis techniques meet rigorous research standards, have the involvement of research, and should be peer-reviewed;
- **Timely yield of information** - he monitoring program must yield information for management in a timely manner;
- **Data management** - how do we most efficiently and effectively manage the volumes of data that are collected by so many different sources and for so many different purposes?

Incorporating Learning into Management Direction

The functions described below will need to be performed with strict reporting timeframes and annual status reports. In order for a program of this magnitude and scope to succeed there are two critical functions that must be fulfilled. The information that results from these efforts must be technically sound and scientifically credible. All interested parties should have faith in the results generate by this program. This requires the technical expertise to organize and execute the work and ensure defensible results that can be transmitted to all sectors of the interested agencies and public. Furthermore, the overall program requires oversight from the appropriate array of stakeholders such that the program is embraced and supported. This oversight drives the priorities and directs the technical efforts. Together the technical and policy functions will provide for the greatest opportunity for the adaptive management program to realize success. Specifically:

The *technical function* is responsible for:

- Ensuring the collection, analysis, and reporting of data and information
- Providing input into adaptive management study questions and study plan design
- Developing policy recommendations in response to new information, study results, emerging trends, etc.

These activities will be performed in a collaborative, coordinated manner with other state and federal agencies and Forest Service research scientists. Technical meetings, status reports, and policy recommendations will be scheduled on an annual timeline.

The *policy function* is performed through the review of technical recommendations and evaluation of current management policies in light of new information. This function will be performed in a collaborative manner with top leadership of state and federal agencies, Forest Service research and other members of the ad-hoc Interagency Team. Open, public meetings will be conducted to solicit input and feedback from stakeholders and the general public. At a minimum, a five-year review of the SNFPA will be conducted at the policy level, using all available information, including the annual reports generated by the technical function.

A *science function* is performed via consultation with the scientific community as the technical and policy functions are conducted.

2.3.4. Alternatives F2-F8 (SNFPA FEIS Alternatives 2-8)

Alternatives 2 through 8 of the SNFPA FEIS are briefly described here, referred to as Alternatives F2-F8. Readers can refer to the SNFPA FEIS, volume 1, chapter 2, pages 83-164, for more detailed descriptions of these alternatives.

Alternative F2 (FEIS Alternative 2)

Under Alternative F2, large reserves would be established where human management would be very limited to maintain and perpetuate old forest, aquatic, riparian, meadow, and hardwood ecosystems. Alternative F2 responds to views that ecosystems should be protected from all but minimal human-caused disturbances and that that natural environments are most desired.

Alternative F3 (FEIS Alternative 3)

Under Alternative F3, restoration of desired ecosystem conditions and processes by active management would be emphasized. These conditions would be determined through landscape analysis, monitoring, and local collaboration. Management activities would promote ecosystem conditions and processes that were within natural ranges of variability under prevailing climates.

Alternative F4 (FEIS Alternative 4)

Alternative F4 would involve an emphasis on the development of forest ecosystem conditions that anticipate and are resilient to large-scale, severe disturbances, such as drought and high intensity wildfire, which are common to the Sierra Nevada. This alternative is consistent with the view that ecosystems should be actively managed to meet ecological goals and socioeconomic expectations. Alternative F4 would have the largest acreage available for active management, including timber harvest.

Alternative F5 (FEIS Alternative 5)

Under Alternative F5, impacts from active management would be limited through range-wide management standards and guidelines. Existing undisturbed areas would be preserved, and other area would be restored to achieve ecological goals. Alternative F5 includes emphasis on reintroducing fire as a natural process and using fire to reduce fuel accumulations and fire damage.

Unroaded areas larger than 5,000 acres, ecologically significant unroaded areas between 1,000 and 5,000 acres, and inner zones of riparian areas would be preserved and left to develop under natural processes. Other areas, including old forest emphasis areas and general forest, would be restored under a limited active management approach to increase the amount of, and enhance processes associated with, old forest conditions. Under Alternative F5, impacts from management activities would be limited by imposition of range-wide management standards and guidelines.

Alternative F6 (FEIS Alternative 6)

Alternative F6 is an integration of old forest and hardwood conservation with fire and fuels management. This alternative includes direction for implementing a landscape-scale program of strategic fuels treatment in high-risk vegetation types across Sierra Nevada landscapes to: (a) reduce the potential for large severe wildfires, and (b) increase and perpetuate old forest and hardwood ecosystems, providing for the viability of species associated with them.

Alternative F7 (FEIS Alternative 7)

Under Alternative F7, a diversity of forest ages and structures would be established and maintained over the landscape in a mosaic approximating patterns that would be expected to be present under natural conditions, which include past, current, and future climates, biota, and natural processes. Ecosystems and ecological processes would be actively managed to maintain and restore them to desired conditions. Silvicultural treatments could produce timber and other forest products.

Alternative F7 would involve few land allocations and application of a *whole forest approach*. Most lands would be allocated to *general forest*, where active management would be used to transform landscape conditions toward desired conditions. Management would be guided by desired conditions for CWHR classes and old forests, specific to the major Sierra Nevada forest types.

Alternative F8 (FEIS Alternative 8)

Alternative F8 involves a cautious approach to treating fuels in sensitive wildlife habitat. New information would be developed from research and administrative studies to reduce uncertainty about effects of fuels management on sensitive species. Until further guidelines were developed, treatments in suitable California spotted owl habitat would retain larger trees, high levels of canopy cover, canopy layers, snags, and down woody material.

2.4. Alternatives Considered but Eliminated from Detailed Analysis

The National Environmental Policy Act (NEPA) requires federal officials to rigorously explore and evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). As also required by NEPA, the range of alternatives considered in detail includes only those alternative that would fulfill the purpose and need for the proposed action described in chapter 1.

2.4.1. Set a Smaller Diameter Limit on Tree Removal

Suggestions have been made to set a maximum diameter for tree removal at less than 30 inches dbh (20-24 inches dbh, for example). This alternative was eliminated from detailed study because it does not respond to the purpose and need for action. Generally speaking, the requirement to retain 40% basal area in the largest trees will result in de facto diameter limit of less than 30 inches. Thus, a lower absolute diameter limit would add another constraint to project design without significantly affecting post-treatment conditions over most of the landscape. The existing direction (S1) includes an array of smaller diameter limits for fuels treatments (12 inches in old forest emphasis areas and California spotted owl home range core areas with some exceptions, 20 inches in general forest and threat zones, and 30 inches in defense zones). The SNFPA Review Team noted that existing diameter limit restrictions have significantly reduced managers' ability to design and implement cost-efficient fuels treatments, and contributed only marginally to meeting needs, especially given other standards and guidelines for canopy cover retention.[2] Canopy cover standards remain an integral part of Alternatives S1 and S2.

2.4.2. Apply the Standards and Guidelines in the Proposed Action to the HFQLG Act Pilot Project Area ***and*** Limit Group Selection in the Pilot Project Area to the Area Planned for the Administrative Study

The standards and guidelines in the proposed action (S2) are being applied in the pilot project area, with a few simple exceptions. Similarly, S1 applied standards and guidelines consistently over the bioregion, including the HFQLG Pilot Project Area.

The objective of providing a flow of products to meet community stability objectives, the management focus for the pilot project area is somewhat different than that for the larger bioregion. Therefore, group selection is proposed as intended by the Act

These differences would be maintained only through fiscal year 2009, at which time the HFQLG forests come under the management standards and guidelines proposed for the remainder of the bioregion or a separate forest plan revision. Because of the similarities of the standards and guidelines and the short duration of the pilot project, the suggested additional alternatives would not result in effects sufficiently different from those of Alternative S1 or S2.

[2] See for example, pages 15 and 40 in the SNFPA Review Team report (USDA Forest Service Pacific Southwest Region 2003).

2.4.3. Apply the Standards and Guidelines in the Proposed Action only to the WUI

This alternative was eliminated from detailed study because it does not respond to the purpose and need for action. Effective and efficient fuels treatments across all land allocations are needed to reduce the risk of catastrophic wildfire to both communities and important wildlife habitat. Adopting the proposed changes only in the WUI would not meet the need to implement an aggressive fuels reduction strategy in the wildlands. Moreover, this alternative would limit the Pacific Southwest Region's ability to embrace the goals of the National Fire Plan by preventing significant acreages of vegetation in fuels condition class 2 and 3 from being treated.

2.4.4. Include Forest Products as a Primary Management Objective

This alternative was eliminated from detailed study because it does not respond to the purpose and need for action. A need has been recognized to treat fuels in an economically efficient manner, which will require that some commercially viable forest products be made available as a by-product of fuels treatments. However, with the exception of the HFQLG pilot project area, the widespread production of commercial forest products is not addressed in this SEIS. Neither Alternative S1 nor S2 has changed the capable, available, and suitable (CAS) timber determination in forest plans. Alternative S1 and S2 did not schedule any regulated timber harvest from these lands. Scheduling of regulated timber harvest and its associated allowable sale quantity (ASQ) will be addressed as part of forest plan revision. The schedule for forest plan revisions is available on the web at http://fsweb.wo.fs.fed.us/em/nfma/index2.htm.

2.4.5. Make Minor Changes to Individual Standards and Guidelines

Changes would include

- eliminating the requirement to leave part of a treatment unit untreated,
- increasing the diameter limits for certain tree species, and
- making slight adjustments in canopy cover requirements for certain land allocations.

These changes were adopted and analyzed in Alternative S2, along with some additional modifications to management direction. Relying on these changes alone would not respond to the purpose and need for action. Specifically, changing the metrics in the existing standards and guidelines would not address the fundamental problems of the prescriptive nature of the existing management direction (economic inefficiencies, complications with implementation, questionable effectiveness of fuels treatments, and inability to treat enough acreage with available funds to effectively modify fire behavior or be responsive to the goals of the National Fire Plan). Moreover, the suggested alternative would not provide local managers with the flexibility needed to choose from an array of tools and techniques to better address site-specific conditions.

2.4.6. Alternative S3 (Staged Implementation)

Alternative S3 would only implement the proposed action for fuels treatments (Alternative S2) in defense zones to protect the communities in the Sierra Nevada from catastrophic wildfire for the first five years. Four adaptive management studies would be initiated in the four demographic study areas for California spotted owls, to better understand the response of owls to various treatments designed to reduce and/or modify fire behavior. If reliable information were obtained from the adaptive management studies after five years, fuels treatments could be expanded to threat zones using the standards and guidelines of Alternative S2. Management outside of defense zones would be guided by the existing SNFPA ROD (Alternative S1), except in threat zones after five years, where Alternative S2 would apply contingent on the results of the adaptive management studies. Under Alternative S3, the HFQLG area would be guided by the same direction as applies to the rest of SNFPA planning area.

This alternative was dropped from further detailed study because it does not differ significantly from Alternative S1.

Applying S2 standards and guidelines in the defense zone closely mirrors S1 direction for the defense zone. Applying S1's standards and guidelines on the remaining landbase represent a continuation of Alternative S1 for five years. This represents a continuation of a cautious approach in the face of uncertainty. Whether results of adaptive management studies would be available in five years to inform changes in management is highly uncertain. Alternative S1 would likely continue as the operative management direction beyond five years. Alternative S2 provides the opportunity for learning to reduce uncertainty through the adaptive management program detailed in chapter 2.

Finally, Alternative S3 does not respond to the purpose and need and new information. Under this alternative, the HFQLG area would be guided by the same direction as the rest of the SNFPA planning area. As discussed earlier (see section 2.4.2), this would not allow for adequate testing of the suite of activities included in the HFQLG pilot project, thereby reducing the knowledge that could be gained from its full implementation.

2.5. Comparison of the Effects of the Alternatives

This section compares the alternatives by summarizing their environmental consequences. Note that environmental consequences for Alternatives F2 through F8 are fully described in the SNFPA FEIS and are only repeated in part in the SEIS.

2.5.1. Old Forest Ecosystems

All of the alternatives would maintain and enhance old forest conditions across Sierra Nevada landscapes. However, they would have different effects on:

- amounts and distribution of old forest conditions,
- potential losses of old forests to wildfire, and
- old forest ecosystem functions and processes.

Amount and Distribution of Old Forest Conditions

The number of large, old trees would increase under all alternatives. With a few exceptions for specific vegetation types or land allocations, all alternatives would have similar effects on the number of large, old trees because the upper diameter limit for tree removal would be 21 inches on the eastside and 30 inches on the westside (table 2.5.1a). The exceptions to these diameter limits are:

- Alternative S1 - Tree removal also would be limited to 12 inches in old forest emphasis areas and 20 inches in general forest and threat zones.
- Alternatives F3, F5, and F8 - In eastside mixed conifer and subalpine types, the upper diameter limit would be 24 inches.
- Alternative F4 - After 15-20% of national forest lands reach old forest conditions, trees greater than the 30-inch dbh limit could be harvested.

Table 2.5.1a. Comparison of Large Tree Retention and Old Forest Connectivity among the Alternatives.

Variable	Alternative								
	S1	S2	F2	F3	F4	F5	F6	F7	F8
Upper diameter limit for tree removal	30" west 24" east	30" west 30" east	30" west 21" east	30" west 21" east	30" west na east	30" west 21" east	30" west 21" east	defined by CWHR classes	30" west 21" east
Percent change in numbers of large trees by 2nd decade	+5.5%	+5.5%	+4.7%	+4.5%	+3.3%	+5.2%	+5.1%	+3.7%	+5.7%
Acreage of old forest allocation (millions of acres)	1.636	1.636	4.873	1.337	0.713	1.745	1.605	defined at project level	2.319

Note: west = westside; east = eastside

Alternatives S2 and F4 would include a larger upper diameter limit on the eastside (30 inches). This could result in tree removal in eastside habitats, which would prolong the time to increase old forest conditions. However, Alternative S2 would require that 30% of the pre-treatment basal area be retained in eastside habitats. This standard and guideline would help to maintain a component of older, larger trees. Alternative F7 would have tree diameter limits that vary by CWHR type.

All alternatives are designed to protect and maintain blocks of old forests (table 2.5.1a). Alternative F2 would meet this goal by establishing biodiversity reserves. The other alternatives would use the old forest emphasis land allocation for this purpose. Alternative F7 would define these old forest allocations through site-specific project level analyses. Alternatives having the most restrictive measures within old forests (e.g. S1) would probably result in the greatest protection for old forest conditions in the immediate future. However, as table 2.5.1b below shows, some alternatives (e.g. S2) would result in large reductions in wildfires, which may provide greater benefit in terms of the amount of old forest conditions available in the long run.

Potential Losses to Severe Wildfires

Over the last 30 years, wildfire in the Sierra Nevada has burned an average of about 43,000 acres per year. In the last ten years, the average has risen to about 63,000 acres per year. Table 2.5.1b below shows that reductions in the number of wildfire acreage burned each year are expected under all alternatives except F2 and F5.

Table 2.5.1b. Comparison of Annual Wildfire Acreage among the Alternatives.

Variable	Alternative								
	S1	S2	F2	F3	F4	F5	F6	F7	F8
Annual acreage of wildfire, first decade	64,000	60,000	68,561	65,804	61,730	69,008	65,705	64,800	67,002
Annual acreage of wildfire, fifth decade	63,000	49,000	76,315	48,381	44,380	71,933	49,579	49,340	62,988
Percent change in annual wildfire acreage from first to fifth decade	-2%	-22%	10%	-36%	-39%	4%	-33%	-31%	-6%

Alternative F4 has the greatest reduction in acres expected to burn annually, followed in order by Alternatives F3, F6, F7 and S2

Old Forest Ecosystem Functions and Processes

Alternatives F5, F6, and F8 would place the greatest emphasis on prescribed burning, and consequently the greatest emphasis on reintroducing fire as a process in old forest ecosystems. Alternatives F5 and F8 would place more restrictions on prescribed burning than Alternative F6. Alternative F6, however, would establish explicit priority on restoring fire as a process in old forests, which would be different than provisions of any other alternative. Alternative F6 would result in the greatest restoration of fire as a process in old forests. Alternatives F4 and F7 would include low to moderate amounts of prescribed burning. However, treatment locations rely more on local discretion, so the extent to which these alternatives would restore fire to old forests is unknown. While Alternative F8 involves higher levels of prescribed burning, provisions in its standards and guidelines would limit the extent of this burning and therefore the amount of fire restoration in old forests. Alternative F2 entails very little prescribed burning and thus minimal restoration of fire to old forests.

Alternatives having the highest likelihood of connectivity between large blocks dedicated to old forests in order are Alternatives F2, F5, F3, F8, and F6. Alternative F4 would involve moderate-sized blocks dedicated to old forests, but the blocks would be widely distributed and therefore more limited in providing connectivity. Alternatives F3, F4, F5, F6, F7, and F8 would include provisions for maintaining old forest patches in the general forest, which would contribute to old-forest connectivity.

Alternatives S1 and S2 include the use of prescribed fire as a treatment method. Alternative S1 embodies a strong preference for the use of prescribed fire as the treatment method in several allocations, such as spotted owl and northern goshawk PACs outside of defense zones; however, limitations due to needs of smoke management and due to high existing fuel loadings may hamper some prescribed burn projects. Alternative S2 would allow more use of mechanical treatments as the initial treatment, with prescribed burning as the follow-up treatment, but requires use of prescribed burning as the initial treatment in PACs outside WUIs.

2.5.2. Aquatic, Riparian, and Meadow Ecosystems

The greatest effects on the Aquatic, Riparian and Meadow Ecosystems will generally be from either mechanical fuel treatments or catastrophic wildfires. The other potential effects from activities such as grazing, mining, pesticide use etc. will either affect only specific sections of the landscape such as meadows or their effects are constant across alternatives. When the balance between fuels treatment acres and risk of catastrophic wildfire is assessed, alternatives that lower the risk of fire and have medium levels of treatment pose the least risk to aquatic and riparian systems. This means that Alternatives F3, F6, S1, and S2 are expected to pose the least risk of negatively impacting riparian and aquatic ecosystems, Alternatives F4 and F7 an intermediate level; and Alternatives F2, F5, and F8 the highest.

Another consideration is the size of material removed and the retention requirements for forest stands. Erman and Erman (2000), found that large openings negatively affect the microclimate of the riparian zone. This means that alternatives that remove smaller material and require higher crown closures will have a greater benefit to the aquatic and riparian ecosystem. Using these criteria, Alternatives F2, F5, F8, S1 and S2 would have the least impact. However, the risk of catastrophic wildfire, which would have a profound effect on forest openings, is high in Alternatives F2 and F5. Thus Alternatives F8, S1 and S2 would have the least overall impact on long term forest structure surrounding riparian areas.

Other factors such as the requirement for landscape analysis, peer reviews, and special protection for sensitive species are components of alternatives that will provide increased protection for the aquatic and riparian ecosystems. Alternatives F3, F5, and S1 all require landscape assessment. These analyses will provide important context to management decisions and allow decisions to consider impacts to and needs of species outside of the immediate project area. The Conservation Assessments completed under Alternative S1 and S2 will inform management decisions in all aquatic and riparian habitats. It will provide some of the basic information needed to better manage habitats for these species. The creation of Critical Refuges in Alternative F5 and Critical Aquatic Refuges in Alternative F2, F6, F8, S1 and S2 will also provide special protection for sensitive species. The conservation assessments and refuges are important first steps in the development of conservation management strategies for aquatic and riparian dependent species.

Alternative S2 may pose higher short-term risks to aquatic resources because it prescribes larger amounts of mechanical treatments and greater treatment intensities. However, these are expected to reduce long-term effects associated with wildfire. Short-term risks associated with S2 will be greatly reduced through the application of the same Aquatic Management Strategy with similar standards and guidelines. Specifically, landscape and project-level analysis, attainment of RCOs, implementation of proven BMPs and other standards and guidelines, a modest reduction in overall road miles, and improved road conditions are the most important aspects of reducing risks to aquatic resources.

Based on all of the above factors, Alternative S1 best protects the values associated with aquatic and riparian habitats. Alternatives S2, F3 and F6 follow closely. The other alternatives have pluses and minuses in their ability to protect riparian and aquatic values. While Alternatives F4 and F7 reduce the risk of wildfire, they lack specific guidance that would provide protection to aquatic and riparian species. On the other hand, Alternatives F2, F5, and F8 provide protective management measures; they also pose the highest risk of catastrophic wildfire.

2.5.3. Fire and Fuels

Weather, topography and fuels influence the behavior of fires. All alternatives influence fires in the Sierra Nevada through a fire suppression program and modification of fuels and vegetation. The annual acreages of wildfire projected for each alternative are presented above in table 2.5.1b. The greatest reduction in the annual acreage of wildfire within the first 5 decades would occur (in decreasing order) under Alternatives F4, F3, F6, F7, S2, F8, and S1. Alternatives F2 and F5 are projected to increase the acreage burned.

Modifying fuel loading across the landscape can effect changes on wildfire behavior by reducing fire intensities and rates of spread. This program also results in safer, more efficient fire suppression efforts. Table 2.5.3a below displays the acreage of fuel treatment (mechanical and prescribed burning) projected for each alternative. Alternatives that accomplish more acres of treatment should result in reduced wildfire severity as well as improved fire suppressions. The alternatives that are projected to modify fuel loadings and change fire behavior the most are F4, F7, F6, S2, and S1, in that order. Alternatives F3, F8, F5, and F2 involve treatments, but on smaller acreages. Note that the estimates in table 2.5.3a do not show the relative effectiveness of fuel modifications by alternative.

Table 2.5.3a. Comparison of Extent of Mechanical and Prescribed Fire Fuels Treatments among the Alternatives.

	Alternatives								
	S1 _1/	**S2**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
Annual acreage of mechanical fuels treatment	51,345	72,200	7,022	30,081	86,168	9,858	33,381	70,045	13,867
Annual acreage of prescribed burns	49,560	42,020	15,457	53,582	46,760	39,356	82,747	60,113	69,038
Total acrege treated annually	100,905	114,220	22,479	83,663	132,928	49,214	116,128	130,158	82,905

_1/ acres based on gross treatment acres

2.5.4. Focal Species

California Spotted Owl

Under all alternatives the quantity and quality of useable habitat available for the California spotted owl is projected to increase across the species range. The alternatives are distinguished by differences in the amount of habitat and management of individual owl nest locations and home range areas. Alternative F4 is projected to produce slight declines in high quality habitat and would not protect all nest (and primary roost) stands. Among the remaining alternatives, Alternative F7 is projected to provide lower amount of useable habitat. Alternatives F2, F3, F5, F6, F8, S1 and S2 would protect all nest stands and have the highest projected increase in habitat values. These alternatives would provide positive benefits to California spotted owls, Alternative F2, F5 and F8 would limit activities within owl home ranges to a greater extent than would the other alternatives, and they could provide increased short-term protection. Improved understanding of relationships between owl habitat patterns at the home range scale and owl demographics, and application of this knowledge at smaller scales, would reduce the risks of implementing any of the alternatives. Alternative S2 has fewer restrictions on treatment methods and intensity within PACs and HRCAs than would Alternative S1.

Northern Goshawk

Alternatives F3, F5, F6, F8, S1 and S2 would provide the greatest contribution to maintaining and enhancing conditions for northern goshawk throughout the Sierra Nevada. These alternatives would protect all goshawk territories, and all are projected to increase amounts of high suitability habitat. Alternatives F4, F7, and S2 would provide less certainty about effects relative to the other alternatives because of the higher rates of mechanical treatments; however, they would provide greater protection from loss due to natural disturbance events.

Willow Flycatcher

The alternatives involve different approaches to managing and conserving willow flycatcher habitat and populations. Alternatives F2 and F8 would result in the greatest improvement in conditions for this species during the breeding season. Given the available data and uncertainties, Alternative F2, which excludes livestock grazing year-round in occupied willow flycatcher habitats, presents the greatest potential benefits to the species. Of all the action alternatives, Alternative F2 is the most likely to support long-term distribution and abundance of this species in Sierra Nevada national forests. Furthermore, Alternative F2 excludes grazing in meadow habitat within 5 miles of occupied sites, allowing for restoration and potential re-colonization of unoccupied sites and the opportunity for willow flycatcher population expansion and recovery.

Alternatives F3, F5, F6, S1 and S2 would provide slightly less improvement of conditions affecting the willow flycatcher than Alternatives F2 and F8. Alternatives F3 and F5 would provide more stringent guidelines than other Alternatives regarding general streambank use but weaker protections than Alternatives F2 and F8 specific to willow flycatcher habitat. Alternatives F3, F4, and F7 would provide an equal to slightly greater level of improved conditions associated with the willow flycatcher.

Alternatives S1 and S2 would apply the AMS and similar standards and guidelines for aquatic, riparian, and meadow ecosystems, to accomplish the same objectives. Alternative S2 involves slight differences relative to S1 where grazing surveys have not been completed, and it allows development of a site-specific management plan to address grazing management where occupied habitat exists. These alternative management strategies are locally determined and are designed to provide sufficient protection of this species.

Forest Carnivores

Four forest carnivores of special concern were identified: marten, fisher, wolverine, and Sierra Nevada red fox. The marten and fisher would more likely be directly affected by all alternatives than would the rarer wolverine and Sierra Nevada red fox, which are associated with higher elevations where relatively little management would take place. Consequences of the alternatives to these species were evaluated in terms of: (1) changes in vegetation structure and composition, (2) recreation and roads, and (3) survey requirements and site protection.

Fisher

Alternatives F5 and F8 would result the greatest improvements to fisher persistence and habitat. Both alternatives would provide fisher habitat through their provisions for retaining and recruiting large trees, snags, and coarse woody debris; retaining dense forest canopy; and promoting hardwoods on conifer sites.

Alternative F2 would provide habitat protections similar to Alternatives F5 and F8; however, because Alternative F2 relies primarily on fire suppression to manage the threat of severe wildfires, the risk of catastrophic fire would be higher under this alternative.

Alternative F3 would result in less benefit to fishers in terms of dead and down wood and hardwoods on conifer sites than either Alternative F5 or F8. Under Alternative F6, canopy closure in denning areas could be reduced to 40% in developed areas within urban WUIs.

All of the action alternatives would protect fisher den sites from human disturbance; however, none of the alternatives would reduce road-related risks to the same extent as Alternative F5. Alternative F5 would reduce potential recreation-related impacts in close proximity to fisher locations and would reduce the impacts of roads and related human disturbance by reducing road density and protecting unroaded areas.

Alternatives F4 and F7 would cause no change or slight increases in fisher habitat and population relative to the other alternatives. Alternative F4 could result in lower fisher abundance and distribution, as it would slightly decrease the availability of habitat elements important to fishers. Alternative F7 would reduce forest canopy from levels required for denning habitat to levels suitable for travel and foraging habitat, but would not change habitat conditions from the current situation.

Alternatives S1 and S2 are similar in projected amounts of fisher habitat over time, with differences primarily due to predicted change in habitat reduction from large wildfires. Under both alternatives a conservation assessment would be completed that could be used to develop a conservation strategy to improve management consistency across the species range. This assessment, coupled with ongoing research, should reduce the level of uncertainty regarding proposed treatments.

Marten

Environmental conditions important to marten and marten population would not be expected to change significantly from the current condition under any of the alternatives. All alternatives would result in retention and development of large trees at levels sufficient to protect and enhance marten habitat.

Under Alternatives F5, F6, F8, S1 and S2 new recreational developments would be evaluated for compatibility with marten needs when they were proposed in suitable marten habitat. In addition, Alternative F5 would reduce the impact of roads and related human disturbance by precluding roading of unroaded areas.

Alternative F2 provides direction for protecting marten habitat; however, this alternative would result in an increased risk of catastrophic fire, which could reduce habitat for this species. Compared to Alternatives F5 and F8, Alternative F3 would provide less dead and down wood and hardwoods on conifer sites.

Alternative F4 would only slightly decrease overall environmental conditions and predicted populations compared to the current condition. Alternative F4, S1 and S2 would reduce forest canopy cover in treated areas because it would establish and maintain both DFPZs and SPLATs. Alternatives F4 and F7 would provide less snag protection, which could lead to lower levels of recruitment of coarse woody debris over time. Alternative F4 has the highest level of fuels treatment and could result in less coarse woody debris recruitment. Alternative F7 emphasizes mechanical treatments over prescribed fire, possibly reducing coarse woody debris recruitment.

Sierra Nevada Red Fox

Although the current distribution of the Sierra Nevada red fox in California is uncertain, the species' range appears to have contracted from the continuous distribution described by Grinnell in the 1930s. Of all the alternatives, Alternative F5 would likely lead towards the greatest improvement in environmental conditions for and population of Sierra Nevada red fox, because it provides the greatest level of meadow protection, emphasizes reducing road densities across landscapes, and encourages new Sierra Nevada red fox surveys. Alternatives F3 and F5 would involve restrictions on recreational activities in unroaded areas. Alternatives F5, F6, and F8, would require detailed evaluation of recreational development on the basis of Sierra Nevada red fox detections and the presence of suitable habitat. Alternatives F6 and F8 would not require surveys, and these alternatives place fewer restrictions on recreation and roads. Alternatives F4 and F7 would provide more of the open forest habitat preferred by the Sierra Nevada red fox than would Alternative F5; however, Alternatives F4 and F7 would place fewer restrictions on recreation and would provide only moderate reductions in roads. Alternative F2 would prohibit off-highway vehicle and over-snow vehicle use in den site buffers. Alternative F2 would not require new surveys for the Sierra Nevada red fox.

Alternatives S1and S2 have similar effects on Sierra Nevada red fox. Alternative S2 clarifies direction to validate sightings of this species by a forest carnivore specialist and clarifies the implementation of a limited operating period to better ensure that it is applied when warranted to reduce the potential to disturb breeding individuals.

Wolverine

Consequences to wolverines are primarily influenced by: (1) recreation and roads and (2) survey requirements and site protection. Based on the combined categories, Alternatives F5, F8, S1, S2 would likely result in the greatest benefit to wolverine persistence and recovery. Alternatives F5 and F3 would restrict recreational activities in unroaded areas. Alternative F5, F6, and F8 would require evaluation of recreational development on the basis of wolverine detections and the presence of suitable habitat. Alternative F5 would emphasize reducing road densities and would encourage new surveys. Alternative F3, S1 and S2 would not provide the same level of benefits as Alternatives F5 and F8 because it would not require surveys, however it would limit activities around locations of verified wolverine sightings.

All Alternatives would increase the extent of suitable wolverine habitat from the current condition, with increases ranging from 5.4 to 9.1%. Alternatives F4 and F7 would result in only slight increases. However, these increases are not significant because none of the alternatives substantially affect the vegetation associated with wolverine habitat, either as interpreted from the standards and guidelines or from habitat utility values projected by the CWHR model. Alternatives F4 and F7 would not encourage surveys, and they would have greater potential for new road development than the other alternatives.

Alternative F2 would pose more risks related to the effects of roads and survey requirements than Alternative F5, but would generally provide greater benefits to wolverines than Alternatives F4 and F7.

As with the Sierra Nevada red fox, Alternatives S1 and S2 would have similar effects on this species. Alternative S2 applies the same clarification regarding verification of sightings by a forest carnivore specialist and implementation of a limited operating period as described for the Sierra Nevada red fox.

Amphibians

Foothill Yellow-Legged Frog

Alternatives F2 and F5 appear to provide the greatest level of protection to the foothill yellow-legged frog, because they provide the most effective management approaches for this species' persistence and recovery. Alternatives F3, F6, F7, and F8 would provide a slight improvement from the current condition. Alternative F4 would decrease environmental conditions compared with the current condition. Information and research gaps, especially regarding the impacts of livestock utilization standards for grass and shrubs on the foothill yellow-legged frog, add uncertainty to this assessment.

Alternatives S1 and S2 apply the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. These alternatives protect discovered populations by designating critical aquatic refuges (CARs).

Mountain Yellow-Legged Frog

Alternatives F3, F5, F8, S1 and S2 would likely result in the greatest improvements in populations of mountain yellow-legged frog, because they provide the most effective management approaches for this species' persistence and recovery. Alternatives F4, F6, and F7 would result in less improvement in population numbers.

Alternatives S1 and S2 incorporate the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. These alternatives protect discovered populations by designating CARs. Some mountain yellow-legged frog populations may exist within habitat for the Yosemite toad, willow flycatcher, or great gray owl. Alternative S2 changes some of the grazing management standards and guidelines related to these species, which could potentially indirectly affect the mountain yellow-legged frog. However, changes in grazing management would require site-specific analyses, including biological evaluations that would address all species occurring within the affected area. Thus, the implications of such changes would likely be minimal.

The U.S. Fish and Wildlife Service has determined that a listing of this species under the federal Endangered Species Act (ESA) as threatened is warranted, but action towards listing is currently precluded due to other priorities. If this species is formally listed in the future, changes in management direction may be warranted.

Yosemite Toad

Alternative F8 would result in the greatest improvement of environmental conditions for the Yosemite toad, because it would provide the most effective management approach for this species' persistence and recovery. Alternatives S1 and S2 will most likely have similar results to F8, but have increased risk associated with some potential for late season grazing effects. Alternatives F2, F3, and F5 would result in slightly less improvement, because of lack of specific direction limiting livestock grazing where the species is present. Alternative F2 includes provisions for establishing an amphibian reserve system to protect known occupied and suitable unoccupied amphibian habitats (FEIS Appendix D, standard and guideline AM12). Alternatives F3 and F5 would protect, known, occupied amphibian habitats. These are based on records over the last 25 years (FEIS Appendix D standard and guideline AM13). Alternative F4 would provide for improvement from the current condition.

Alternatives S1and S2 applies the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. These alternatives protect discovered populations by designating CARs. Alternative S2 changes some of the grazing management standards and guidelines related to the Yosemite toad. It allows use of alternative management strategies that are locally determined to provide sufficient protections for this species. Although the intent of these alternative management strategies is to provide for and protect habitat for the species, some difficulties in implementation may increase the risk of success in avoiding impacts to Yosemite toads. Some of these risks would arise with Alternative S1 as well and are due to the difficulty in managing livestock in the forest environment.

The U.S. Fish and Wildlife Service determined that a listing of this species under the ESA as threatened is warranted, but action towards listing is currently precluded due to other priorities. If this species is formally listed in the future, changes in management direction may be warranted.

Cascades Frog and Northern Leopard Frog

Alternatives F5, F8, S1 and S2 would likely result in the greatest improvement of conditions for the Cascades frog and northern leopard frog, because they provide the most effective management approaches for this species' persistence and recovery.

Alternatives S1 and S2 apply the AMS and the same standards and guidelines for aquatic, riparian, and meadow ecosystems. Under these alternatives, populations would be protected as they are discovered by designating CARs. Some populations of these species may exist within habitat for the Yosemite toad, willow flycatcher, or great gray owl. Alternative S2 involves changes to some of the grazing management standards and guidelines related to these other species, which could potentially indirectly affect these frog species. However, changes in grazing management would require site-specific analyses including biological evaluations that would address all species occurring within the affected area. Thus, the implications of such change would likely be minimal.

2.5.5. Socio-Economic Concerns

Economy

National forest management directly affects the socioeconomic environment of the Sierra Nevada through employment and income derived from resource extraction, production, and use. Timber harvest from national forest lands provides a flow of products to area industries.

Alternatives F4, F7, and S2 would provide the largest number of jobs annually in the commercial logging sectors. Consequently, these alternatives would also result in the highest estimated annual earnings in these economic sectors. (Table 2.5.7a)

Table 2.5.7a. Comparison of Estimated Average Annual Employment and Earnings from Commercial Timber Harvests on National Forests among the Alternatives in the First Decade.

	Alternative								
	S1	**S2**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
Estimated average annual jobs	957	1,894	145	566	3,467	322	526	2,730	222
Estimated average annual earnings (thousands $, 1995)	38,344	57,159	7,458	26,099	116,023	14,345	26,136	89,913	12,212

Commercial Forest Products

Table 2.5.7b displays the modeled annual yield of green and salvage harvests by alternative for the first two decades. These estimates include the timber volumes produced under the HFQLG pilot project. The amount of salvage volume projected for each alternative is well less than the amount of annual mortality (700 million board feet [MMBF]) estimated for these forests in the SNFPA FEIS (volume 2, page 380).

Six of the alternatives would produce volumes exceeding 100 MMBF annually. In decreasing order of volume production, these alternatives are F4, F7, S2, F6, F3 and S1. The remaining Alternatives (F5, F8, and F2) would produce less than 100 MMBF annually. For comparison, the average amount of timber offered during the six years following adoption of the California spotted owl guidelines (CASPO guidelines) (1994-1999) was 372 MMBF per year.

The amount of green volume offered in the second decade is less than in the first for each alternative. Maintenance of previously treated areas will be a significant part of the annual program of work, which will result in less volume offered.

Table 2.5.7b. Comparison of Estimated Annual Timber Harvest Volume (Green and Salvage) Offered for Sale from National Forests among the Alternatives (MMBF/yr).

	Alternative								
	S1	S2	F2	F3	F4	F5	F6	F7	F8
First Decade									
Salvage timber	30	90	17	33	238	29	91	142	42
Green timber	70	329	22	84	534	49	80	414	33
Total timber	100	419	39	117	722	78	171	556	75
Second Decade									
Salvage timber	30	90	17	33	238	29	91	142	42
Green timber	20	132	7	21	294	7	57	210	14
Total timber	50	122	24	54	522	36	148	352	56

Table 2.5.7c summarizes the estimated commercial biomass output that could be available for sale under each alternative by decade. Alternative S2 is projected to produce the largest amount of commercial biomass, followed by Alternatives F7, F4, and S1. The other alternatives would produce between 9% (Alternative F2) and 41% (Alternative F6) of the amount of biomass produced by Alternative S2.

Table 2.5.7c. Comparison among the Alternatives of Potential Commercial Biomass Output from National Forests in the First Decade (1,000s of bone dry tons).

Alternative								
S1	S2	F2	F3	F4	F5	F6	F7	F8
4,385	7,021	660	2,440	6,200	1,710	2,910	6,680	1,720

Grazing

All alternatives would reduce the current numbers of livestock permitted to graze on national forest lands because total forage (as measured by animal-unit months) offered by the national forests would decline (table 2.5.7d). Alternatives F4 and F7 would have more suitable rangeland (acreage available for grazing) than the other seven alternatives.

Table 2.5.7d. Comparison among the Alternatives of Reduction in Animal-Unit Months Offered by National Forests.

Alt S1	Alt S2	Alt F2	Alt F3	Alt F4	Alt F5	Alt F6	Alt F7	Alt F8
83,000	83,000	140,000	69,000	56,000	172,000	72,000	56,000	110,000

Alternatives F2, F5 and F8 would establish more conservative standards and guidelines related to grazing activities than would the other alternatives. These standards and guidelines would remain in effect on a particular range until a range analysis could be completed to determine the range condition. In many cases, these conservative standards would make it uneconomical for permittees to graze their allotments while waiting for an analysis to be completed. Because many years would be required to complete analyses of several hundred allotments on the Sierra Nevada national forests, many permittees would probably give up their permits.

Alternatives F4 and F7 would cause the least reduction in grazing use. F2, F5, and F8 would cause the greatest reductions in grazing use. The intermediate alternatives in order of least to greatest reduction in grazing are F3, F6, and S2/S1.

Alternatives S1 and S2 were further evaluated by estimating effects on allotment permittees. By employing alternative strategies to protect wildlife species, Alternative S2 is estimated to eliminate the grazing deferral described above for 14 allotment permittees, whereas Alternative S1 would require grazing deferral by these 14 allotment permittees. Seven permittees would be very highly impacted by both Alternatives S1 and S2. (Table 2.5.7e)

Table 2.5.7e. Comparison of Effects to Permittees between Alternatives S1 and S2.

	Alt S1	Alt S2
Number of permittees slightly affected	11	7
Numbers of permittees moderately affected	17	10
Number of permittees highly affected	12	9
Number of permittees very highly affected	7	7

Roads

The forest development road arterial system would remain in its current location in Alternatives F2-F8 and S1. No arterial roads would be decommissioned. Improving arterial roads would continue to be a priority for road construction funding.

The forest development road collector system would also remain in its current location in these alternatives. Construction or decommissioning of collector roads would be unlikely. Collector roads would be improved and managed to provide a more stable road surface, primarily using gravel and dust abatement.

The most substantial changes in the forest development road system would be changes in the mileage and conditions of local roads. Some roads would be improved to reduce impacts on adjacent resources, but typically local roads have lowest maintenance priority. Some local roads may become undriveable due to vegetative encroachment. The mileage of local roads would decrease, because some local roads would be decommissioned.

The mileage of unclassified roads would also decrease. Unclassified roads would be evaluated as they were encountered during planning of vegetation treatments. Some unclassified roads (e.g. those supporting unauthorized uses) would be decommissioned. Others providing needed access would be improved and added to the forest development road system. In some areas the size of the forest development road system would increase as needed roads were added to it. If these roads were supporting authorized uses, adding them to the forest development road system would not affect existing public access.

Alternative S2 would result in different effects on the roads system than the other alternatives. Alternative S2 would allow construction, maintenance, and decommissioning of roads in support of full implementation of the HFQLG pilot project. This will result in an increase in the mileages of the forest development collector system and local road system, along with decommissioning other roads.

Air Quality

Emissions of particulate matter larger than 10 microns (PM_{10}) would be expected to differ by alternative in proportion to the acreages of wildfire and prescribed burning that would occur. Total emissions are expected to increase over time for Alternatives F2 and F5, given the projected increase in wildfire acres. All other alternatives (S1, S2, F3, F4, F6, F7, F8) should result in a reduction in total emissions, simply as a result of wildfire reduction.

Table 2.5.7f displays annual emissions of PM_{10}, based on acreages of wildfire and prescribed burning projected for each alternative. Comparison of all alternatives shows 43% difference in annual emissions between the lowest emitting (S2) and highest emitting (F6) alternative. Although Alternatives S2 and S1 would involve larger acreages of prescribed burning than under Alternative F2 (Table 2.5.3a), Alternative S2 would result in the lowest total PM_{10} of all of the alternatives. This result is due primarily to the relatively small acreage burned by wildfire under this alternative and because mechanical treatments would be used extensively to reduce fuel loadings prior to prescribed burning. Alternative S1 would result in the next lowest total PM_{10} emissions.

Mechanical fuels treatments can reduce the amount of particulate from wildfires and from prescribed burns. As shown in Table 2.5.3a, Alternatives F4, S2, S1, and F7 include the largest amount of annual mechanical fuel treatments. Over time (decades), particulate emissions from wildfires as well as prescribed burning on treated areas should diminish.

Timing of prescribed burns helps reduce particulate emissions during periods of critical air quality. Because all projects are to be designed to keep smoke emissions from causing violations of ambient air quality standards, all alternatives are consistent with provisions of the Clean Air Act.

Table 2.5.7f. Comparison of Particulate Emissions among the Alternatives in the First Decade (Tons of PM_{10})

	Alternative								
	S1	**S2**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
Annual wildfire emissions	23,700	22,600	25,300	24,300	22,800	25,500	24,200	24,000	24,700
Annual prescribed fire emissions	2,000	2,400	3,500	12,600	11,900	9,200	18,100	13,900	14,500
Total annual emissions	25,700	25,000	28,800	36,900	34,700	34,700	42,300	37,900	39,200

Recreation

In general, all of the alternatives could have localized effects on certain types of recreation activities on national forest lands. Alternatives F2, F3, F5, F6 and F8 would cause a slight reduction in the number of recreation visitor days (RVDs). These alternatives would favor a trend toward more dispersed, non-motorized recreation, such as hiking and backcountry camping. Alternatives F4 and F7 would maintain the current level of RVDs.

Alternatives S1 and S2 would have similar effects on recreation. Alternative S2 clarifies direction contained in Alternative S1 to explicitly apply limited operating periods for protection of various wildlife species to vegetation treatments and not to recreation related activities. However, new recreation activities still require analysis under NEPA, and recommendations for limited operating periods could be adopted as deemed necessary at the project level. Alternative S1 includes direction that may limit recreational pack stock activities in meadows containing or potentially containing willow flycatchers and/or Yosemite toads.

Chapter 3: Affected Environment

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Chapter 3: Affected Environment

Introduction

The information provided here supplements the documentation of the affected environment contained in chapter 3 of the *Sierra Nevada Forest Plan Amendment* (SNFPA) *Final Environmental Impact Statement* (FEIS) (January 2001). The focus of this chapter is on specific areas for which new information or analysis is relevant to the decision to be made. The following sections describe changes in environmental conditions observed since the FEIS was completed and highlight key findings and new information identified in the *Sierra Nevada Forest Plan Amendment Management Review and Recommendations* (USDA Forest Service Pacific Southwest Region 2003g).

3.1. Physical and Biological Environment

3.1.1 Climate and Climate Change

Climate is a determinant of the Sierran landscape. Climate and its changes are a primary and overriding force that has sculpted the structure, species composition (including large scale movement and local extirpation), density, and productivity of the biotic communities of the Sierra Nevada. It has profound influence over hydrology, soils, and landforms (glaciation, erosion). Climate also has dramatic impacts on other environmental factors such as fire, insects and pathogens, and evolution. In addition, climate is constantly changing in complex and nested cycles that operate at several time scales (millennia, century, decade, and annual), with some changes being dramatic and relatively sudden (Millar 2003).

Climate change and its effects on forest vegetation, insects and pathogens, fire regimes, wildlife, air quality, and hydrology are addressed throughout the SNFPA FEIS. Supplemental information provided in this section acknowledges the dynamics of climate change and its role as a primary architect of the vegetation communities of the Sierra Nevada, discusses the implications of climate change for forest planning, discloses risks and uncertainties, and links climate change with adaptive management.

FEIS Consideration of Climate Change

The impacts of climate change on vegetation dynamics is briefly discussed in chapter 3, part 3.1 (pages 60-61) of the FEIS. The role of climate change shaping the vegetation of the Sierra Nevada, with emphasis on old-growth forests, is discussed in more detail in part 3.2 (pages 123-124). The structure and composition of vegetation is discussed in light of historic climatic changes that caused some considerable individual species migration and community composition shifts over the course of 4.7 million years. Changes in fire regimes in response to climatic change and resultant effects on vegetation are also discussed. Fires, insects and pathogens, and climate change and their interactions are identified as the most prevalent historic forces that influenced old forests. Cautions about the use of historic conditions as analogues for desired conditions are also addressed. Impacts of climate change on species composition, forest density, and horizontal distributions and patterns are discussed in chapter 3, part 3.2 (pages 149-150).

The variability and uncertainties presented by climate change are integrated into desired conditions for the landscape mosaic and old forest patches by forest type. Inherent in the definition of desired condition is the assumption that “the distributions are broad enough to allow for shifts in vegetation over time in response to climate change within the time frame of this FEIS” (chapter 2, page 136 of the FEIS).

The role of climate change on hydrology and water as a force of change is discussed in chapter 3, part 2 (page 32). Impacts of climate change on fire regimes are acknowledged in chapter 3, part 2 (page 35).

The role of climate change on wildlife species of the Sierra Nevada is addressed in chapter 3, part 4. Generally, climate change is addressed as a non-habitat risk factor that is outside the control of the Forest Service. For example, both marten and fisher are at the southern-most extents of their ranges in the Sierra Nevada. These species are at relatively higher risk to climate driven changes since they are at the periphery of their biogeographic ranges (chapter 3, part 4.4, pages 6 and 24.). Climate change is also identified as a potential factor in the decline of the foothill yellow-legged frog (chapter 3, part 4.4, page 212) and Yosemite toad (chapter 3, part 4.4, page 222).

Modeling of Old Forest Emphasis Areas place emphasis on delineation of rare or concentrations of desired entities (i.e. species, communities, or ecosystems) in large enough areas that they provide functional landscape units that allow for ecosystem processes including, for example, fire or metapopulation interactions and connectivity at the broader scales for genetic diversity and response to climate change (Appendix B-11).

Climate Change and the Sierra Nevada

The science of climate change is rapidly developing. Within the last 20 years, scientists have made great strides unraveling the history of climate change, based largely on information recorded in tree rings; lake, bog, and ocean sediments; tree invasion of meadows; coral reefs; and ice packs. Integrated assessments of this body of information paint a picture of continual change and nested oscillating cycles operating at several time scales whose additive effects may cause dramatic and sometimes sudden changes.

Climate is not as much a landscape component as it as a landscape determinant. It exerts an overriding influence on such landscape components as vegetation (including its type, biomass, and distribution); hydrology (including the size, distribution, fluctuations, and water quality of lakes and rivers); soils (including thickness, stability, and nutrient capacity); and landforms (including their rates of formation and loss). It also strongly influences other landscape determinants, the most important of which may be fire (including its location, frequency, and intensity) (Stine 1996).

Climate is also inherently site specific, differing even over small areas depending on such variables as topography, slope orientation, vegetation coverage, and elevation (Stine 1996). Vegetation patterns, structure, and distribution are a product of the interaction of the adaptability and needs of the species, responding to the climate and characteristics of the sites. In a range as large and diverse as the Sierra Nevada, the interactions are extremely complex, and in light of possible climate change, exceeding difficult to predict.

Climate is inherently changeable, at multiple scales of time, with resultant effects on biotic communities in the Sierra Nevada. Assessments of historic vegetation during the Quaternary (the past 2.4 million years) and Tertiary (2.5 to 65 million years ago) periods show dramatic changes in vegetation in response to climatic change (Millar 1996, Woolfenden 1996). Species responded individualistically to these changes, moving along elevational or latitudinal gradients, sometimes assembling into communities with no known modern analogue. Some species went extinct within the range. In the recent past, vegetation has responded to a general warming trend around 10,000 years ago, an increase in effective precipitation about 6,000 years ago, a cooler period 3-4,000 years ago, a brief warm-dry period between A.D. 900 and 1300, and a subsequent 400-year period with cooler and wetter conditions and multiple advances of alpine glaciers known as the Little Ice Age (Woolfenden 1996). Around 1850, just as Europeans began to arrive in the Sierra Nevada, the region experienced a marked shift in climate from the cool and moderately dry conditions of the Little Ice Age to the relatively warm and wet conditions that have characterized the last 145 years (Stine 1996).

Today's Sierran forests are a snapshot in time of the interaction of a dynamic climate and site conditions and the response of plant and animal species (and communities) to these forces. Only fairly recently have anthropogenic influences (fire use, fire suppression, timber harvest, development, introduced species, greenhouse gases, pollutants) significantly impacted large expanses of the Sierra Nevada.

Climatic Cycles

Analysis of climate change reveals a picture over the past two million years of oscillatory climate change operating simultaneously at multiple timescales. The multi-millennial cycles have average differences of 10-15 degree centigrade and are driven by cycles of the earth's orbit around the sun and the resulting solar heat received by the earth of glacial/interglacial periods. Nested within the glacial/interglacial cycles are century-millennial climate oscillations, paced primarily by cycles in solar activity. Within the century-millennial climate oscillations are interannual to decadal fluctuations generated by ocean/atmospheric dynamics (Millar, in press). The additive effects of these changes may be dramatic, driving average temperatures up and down by as much as 20 degrees centigrade. Moreover, rather than always being gradual, climatic shifts have often been abrupt, with marked changes in temperature and precipitation taking place over periods as short as a few years or decades (Millar 2003). Anthropogenic influences (greenhouse gases, large scale vegetation, and manipulation) on climate are a fairly recent addition to the complex interactions that drive climate oscillations.

Millar (in press) also notes that climate change functions as an important recurring agent of ecological change, with each scale of historic cycling tracked by changes in vegetation. Primary responses at multi-millennial scales are major migrations, range shifts and population extirpations, and colonizations. Cyclical range changes of Monterey pine along the California coast, for example, demonstrate vegetation responding to millennial scale climate oscillations. Similar types of change at smaller magnitudes characterize century-millennial oscillations, as evidenced by limber pine colonization and extirpation throughout large watersheds in the Sierra Nevada and Great Basin. Annual and decadal climate oscillations provoke primarily changes in productivity and abundance of plants.

The historic record of the Sierra Nevada indicates high variability of species abundances within locations, changes in species extent and distribution (especially at geographical and ecological margins), changing species diversity within plant communities, movement of plant communities around the range, and changing fire regimes over even relatively short time (Millar and Woolfenden 1999).

Implications for Managers

Climate change is a background force that affects all aspects of ecosystem form and function in the Sierra Nevada. Climate is variable on annual to millennial scales and affects ecological dynamics from short-term (population genetics, population growth, and decline) to long-term (evolutionary trajectories, native species ranges, community composition). Climate also affects other ecosystem forces such as fire, insects, and diseases that dramatically impact Sierran forests. Despite recent knowledge gains, climate change is not fully understood and there are significant information gaps. Short-term (interannual-decadal) projections are reasonably reliable, but long-term projections are still highly speculative and subject to error.

It is also difficult to establish base-line conditions that serve as target for ecosystem restoration. It is tempting to use conditions during the period just prior to European settlement as a model for what the Sierra should look like today. However many scientists caution against managing for an idyllic "steady state" based on conditions that may have developed in response to cooler and wetter conditions of the century prior to the gold rush. In the past, native species have existed under drastically different climatic and environmental conditions, assembled into mixes not seen in the recent past, and have evolved and responded to current and changing conditions. For example, the massive drought and insect mortality event occurring in the San Bernardino Mountains will have long-term impacts on the distribution and composition of forest vegetation in the affected area.

Millar (1996) cautions that the assumptions about the behavior of native species in the future under unknown climate and/or under novel management regimes should not be based solely on the behaviors of species in current (or past) environments. She urges that the most appropriate management action is to maintain diverse, healthy forests with conditions favoring resilience to unpredictable but changing future climates and management regimes. Management programs that build flexibility, reversibility, and alternative pathways are more likely to succeed in an uncertain future than plans that require landscapes to reach precise vegetation targets. Stine (1996) argues that efforts to restore landscapes should not focus on the pre-European landscape, but rather on the landscape that would have evolved during the past century and a half in the absence of Europeans. Providing for fluidity in species boundaries and plant community structure and composition has been a dominant feature in Sierran ecosystems and may be a significant mechanism that enables species sustainability over time (Millar and Woolfenden 1999).

Alternatives addressed in this SEIS prescribe a schedule of treatments as well as standards and guidelines to improve the resilience and sustainability of Sierran Ecosystems with emphasis on conservation of old forests and associated species; addressing problems with aquatic, riparian and meadow ecosystems; and addressing the risk of catastrophic fire. These management activities should lead to incremental improvement of the resilience of these ecosystems to unpredictable climate change. Climate will be a continual change force working on these systems coincident with management activities, so cause and effects will be difficult to discern.

Through monitoring, feedback, and adaptive management, the effectiveness of treatments in light of climatic interactions will be assessed and modified within the context of the standards and guidelines in this document. Adaptive management of Sierran ecosystems will be implemented with due consideration of the developing body of information on climate change.

3.1.2. Forest Ecosystem Health

Background

Forest and Vegetation Health Concepts, Definitions, and Additions to FEIS

For purposes of this discussion, the terms *forest and/or ecosystem health* refer to the response of vegetation to climate change, drought, insects, and pathogens, as well as the composition and structure of vegetation relative to desired conditions. The SNFPA FEIS provided some information concerning ecosystem conditions and consequences of the alternatives regarding key aspects of forest and ecosystem health. Desired vegetation conditions identified in the FEIS, particularly those related to canopy density and species composition, were intended to achieve greater resilience to drought, climate change, and insect and disease-related mortality compared to current conditions. This supplemental environmental impact statement (SEIS) provides more background information on each of these affecters of forest health.

Drought

The vegetation composition, structure, fire regime, and insect/pathogen-related mortality for a given landscape or bioregion depend, in part, on prevailing climate. Climate characteristics such as temperature and precipitation are in continual flux. The rate and direction of climate change also varies with time. The magnitude and degree of climate change depend, in part, on the scale of time period examined. For example, droughts occur when precipitation changes to lower levels on an annual time scale. An overall climatic regime can vary over thousands or millions of years. This discussion focuses on droughts, either as part of the current climatic regime or projected future climate regimes.

Historically, droughts have been common in the planning area. Various analyses of tree-ring data suggest that the more recent drought periods (within the last 100 years) are not anomalies when considered in the long-term context of 1,000 years (Fritts, Lofgren, and Gordon 1980, Graumlich 1993, Fritts et al. 1979). These studies indicate that California has experienced at least six periods of significant precipitation deficit since 1600. In the perspective of a 360-year reconstruction of precipitation, the period since 1890 has been one of moisture surplus. This surplus, in combination with fire suppression and selective removal of the more drought-tolerant pine species since European settlement, has resulted in increased forest densities and changed species composition. These changes have made forests and other vegetation communities in California more susceptible to drought-induced mortality.

Insect/Pathogen-Related Mortality

Vegetation near the limits of species distributions (especially where precipitation is limiting) is particularly vulnerable to drought (Dale et al. 2001). This phenomenon is evidenced by the greater concentrations of high-mortality events in the eastside and lower elevations of the westside of the project area during the droughts of the last century. Further, large portions of the westside mixed conifer zone, particularly on drier portions (ridgetops, upper slopes, south and west-facing aspects), are also vulnerable to high levels of mortality during droughts, especially where precipitation levels are lower (<40” average annual precipitation). Although not as dry as the eastside forests, these areas of mixed conifers are more productive, causing stand densification from fire suppression and consequently competition for scarce water resources, to be elevated (Franklin, personal communication 2003). Reports of drought-related insect/pathogen mortality in mixed conifer forests in the Stanislaus National Forest in 1924 support the notion of greater vulnerability of these drier portions of the mixed conifer forests (Meinecke 1925).

Projections for climate change in the Western U.S. include both increases in mean temperature and increases in precipitation (Dale et al. 2001). However, there is also a trend toward greater fluctuations in precipitation and temperature. The fluctuations, particularly toward low precipitation, are more important than mean trends in interpreting potential consequences of future drought. The extensive vegetation mortality currently being experienced in the San Bernardino National Forest and in large areas of the Southwest (Arizona, New Mexico, and Utah) provides a stark example of the potential consequences of several years of drought in dry ecosystems. In addition to extensive mortality in conifer-dominated forests, entire hillsides of very drought-tolerant manzanita, live oak, and pinion-juniper are dead or dying in theses regions.

Stand Density

Stand density, along with species composition, is an important factor in determining the degree of vulnerability to severe drought and insect/pathogen related mortality. Forest managers recognize the relationship between stand density and tree mortality and growth rates. Increasingly, the Stand Density Index (SDI) is used to assess stocking levels. SDI provides a standardized method for calculating a given stand’s density based on an index value for 10-inch diameter trees per acre. Threshold SDI values for forest health have been estimated for Sierra Nevada conifers and are used as reference points when individual stands are being diagnosed. The limiting SDI for ponderosa and Jeffrey pine is 365; it is 800 for white fir and 1,000 for red fir. These are limiting but not sustainable densities. For example, when the SDI of ponderosa pine stands approaches 365, large losses from bark beetle epidemics usually result. Mortality begins to occur in these stands at SDI levels near 230 (Oliver and Uzoh 1997). While SDI is more difficult to measure in the field than basal area, its insensitivity to the age of the stand and to site quality make it a desirable measurement variable.

Forestry inventory mapping, by canopy closure, provides additional information regarding intertree competition levels. Based on the degree of closure, these maps assign a letter designation to reflect the canopy closure level. Areas with canopy closure levels > 40% commonly contain groups of trees with moderate to high intertree competition levels. The "N" class (>40-69%) and the "G" class (>70%) account for approximately 4.2 million acres. These acres are at risk of drought/insect-related mortality. For the individual tree, density is defined by its own neighborhood. Area-wide classifications reflect the average density within the mapped area. These average values, therefore, likely underestimate or overestimate densities at specific points within the stand. Despite this lack of tree-level precision, it reasonable to assume that high density exists on several million acres.

Forest density also influences trends in species composition. Greater densities favor perpetuation of shade-intolerant species (e.g. white fir and incense cedar) and lower densities offer more opportunity for regeneration and recruitment of shade-intolerant species (e.g. ponderosa pine).

Insects/Pathogens and Abiotic Factors

Insects and diseases have the potential to alter vegetation in a relatively short time. A bark beetle outbreak in combination with drought conditions can cause widespread mortality over a large area in a single season. Management activities that promote tree health and vigor also reduce the potential damage from insects and diseases. The significance of effects of insects and diseases on vegetation depends on their impacts on ecosystem structure and function and specific management goals and objectives.

Historically, the most significant widespread, weather-related effect on vegetation in the Sierra Nevada has been conifer mortality because of severe moisture stress and consequent infestation by bark and engraver beetles. Conifer mortality tends to increase whenever annual precipitation is less than about 80% of normal. Wide fluctuations in annual precipitation are a common occurrence in California, and recurrent droughts have been a long-standing feature of the Sierra Nevada climate (Ferrell 1996). Since the late 1800's, moderate to extreme (on the *Palmer Drought Index* scale) drought periods in California occurred in the periods 1897-1900, 1923-1925, 1930-1934, 1946-1949, 1958-1962, 1975-1977, 1987-1994, and most recently, 2000 to the present.

The key insect pests and pathogens affecting Sierra Nevada forests usually function as members of biotic complexes in which the members are highly interactive. In California's Mediterranean climate, drought is probably the most important predisposing factor to these complexes (Ferrell 1996). But overly dense stand stocking, fire, logging, urbanization, air pollution, snow breakage, windthrow, and flooding can also weaken trees and predispose them, or cause them to become susceptible, to pathogens and insects. Like biotic complexes, environmental factors can be highly interactive.

Insects

Both bark beetles and defoliators can impact Sierra Nevada forests. Defoliators include the Douglas-fir tussock moth (*Orgyia pseudotsugata)*, the pandora moth (*Coloradia pandora),* and the Modoc budworm (*Choristoneura vididis).* Defoliator impacts are periodic and include growth loss, top-kill, and mortality.

Bark beetles have the largest impact. Sporadic outbreaks cause widespread mortality in virtually all major coniferous species and forest types. The bark beetles associated with tree mortality include western pine beetle (*Dendroctonus brevicomis)* in ponderosa pine, Jeffrey pine beetle (*Dendroctonus jeffreyi)* in Jeffrey pine, mountain pine beetle (*Dendroctonus ponderosae)* in lodgepole pine, sugar pine, and ponderosa pine, and fir engraver (*Scolytus ventralis)* in red fir and white fir.

Red turpentine beetle (*Dendroctonus valens)*, often found in association with other pine bark beetles, is commonly seen after prescribed fire and can contribute to mortality.

Pine engravers such as *Ips paraconfusus* and *Ips pini* periodically infest green pine slash. *Ips* species can also kill large groups of trees during drought periods. Host material can be created through wind events, snow breakage, or harvesting activities. Residual trees can be attacked simultaneously when pine engravers are infesting the slash or later by emergent populations that have developed in the slash. Attacks to pine trees can result in top kill or whole tree mortality. In the warmest part of the summer, *Ips* beetles can complete their life cycle in 35-40 days. All the above insects are native to the Sierra Nevada, play a diverse role in forest ecosystem dynamics, and have co-evolved with the vegetation.

Mortality related to pine bark beetles (western, mountain, and Jeffrey pine beetles) and fir engraver beetles occurs primarily in small groups or in single trees scattered over several hundred acres. Successful attacks by pine bark beetles result in tree mortality. Successful attacks by the fir engraver (in red and white fir) can result in top-kill, branch kill, patch kills along the bole, or whole tree mortality. In general, mortality occurs in overstocked stands and often in combination with diseases; however, during periods of protracted drought, mortality may be expected to occur in stands having various stocking levels.

In part because of the biology and host selection behavior of bark and engraver beetles, the condition or vigor of the host tree is the critical determinant of a successful attack. Conifer hosts growing under healthy, vigorous conditions are best able to resist attack through their evolved defense mechanisms. Trees that have been weakened by some factor or agent, including drought, disease, physical injury, lightening, fire, and/or between-tree competition due to overstocking, are more likely to be successfully attacked. Consequently, regulation of stocking and species composition through vegetation management, in combination with the reduction of other predisposing factors, allow trees to grow as healthy and vigorously as possible and prevent or reduce chances of successful attacks by bark and engraver beetles and subsequent mortality.

Douglas fir tussock moth (DFTM) (*Orgyia pseudotsugata*) is also found in mixed conifer/white fir stands in the Sierra Nevada. Historically, this defoliator has erupted about once every 10 years somewhere within the mixed conifer/white fir type in the Southern Cascade and Sierra Nevada ranges. Repeated defoliation by DFTM can cause white fir mortality.

There is no circumstantial evidence that direct suppression of Jeffrey pine beetle infestations through removal of infested trees in selected areas, prior to beetle emergence, has reduced the number of trees subsequently killed in the treated area (Wenz, personal communication). This treatment has been successfully implemented on the Truckee Ranger District of the Tahoe National Forest National Forest, the Inyo National Forest, the Lake Tahoe Basin Management Unit, and in Lassen Volcanic National Park. Rapid removal of infested trees prior to beetle emergence has resulted in fewer trees being attacked the following year and the maintenance of a Jeffrey pine component in the stand.

Low to moderate intensity fire can damage some residual trees to the extent that they become more susceptible to bark beetle attacks. Forest fires of sufficient intensity or duration to injure cambium and foliage of trees can increase a tree's susceptibility to bark and/or engraver beetles. Many trees that have been only moderately injured by the fire and are capable of recovering may be attacked and killed by beetles after a fire. Red turpentine beetles (*Dendroctonus valens)*, for example, are commonly found attacking conifers in areas that have burned by either prescribed fire or wildfire. Fire-injured trees can attract beetles for one or two seasons following a fire; however, this phenomena does not appear to commonly occur in the Sierra Nevada, and bark beetle responses following fires are not alike in all situations. While fire injured trees can attract bark beetles in considerable numbers, they do not always afford favorable breeding conditions for new beetle broods. Some of the factors involved in post-fire bark beetle attacks are level of stress of trees prior to the fire (i.e. drought-stress), bark beetle population levels prior to the fire, fire season occurrence, and timing of salvage operations. In addition, fires that result in cambium damage can also create openings for pathogen entry.

Pathogens and Abiotic Conditions in the Sierra Nevada

White Pine Blister Rust (Caused by *Cronartium ribicola*)

A non-native fungus affects white pines (sugar, western white, whitebark, limber, foxtail pines) and its alternative host, *Ribes* spp. The principal effect is mortality of trees that become infected. Smaller trees die rapidly. Mature trees may survive infection, although with sufficient infections, they can be predisposed to bark beetle attack.

Dwarf Mistletoes (*Arceuthobium* Species)

Dwarf mistletoes are common in the Sierra Nevada forests. They are parasitic seed plants that attack members of the Pinaceae family. They are relatively host-specific and require a living host for survival. They cause reduction in growth rate, development of deformities (cankers, witches brooms), and increased susceptibility to bark beetle attack and mortality. Stocking levels, abundance of precipitation, and insect presence determine how dwarf mistletoes affect their host. They cause the most serious diseases affecting ponderosa and Jeffrey pine in California, infesting 26% of the ponderosa pine type (Bolsinger 1978). In California, this disease ranks second in importance to annosus root disease in damaging white fir, affecting 30% of all white fir (CFPC 1960). Dwarf mistletoe is a damaging disease in the eastside pine forests, infecting about 9% of the ponderosa and Jeffrey pine surveyed during 1958-1966 (Smith 1983a). Recent summaries of national forest inventories (Kliejunas, unpublished information) indicate that over 2.2 million acres (25%) of productive national forest system land in California are infested with dwarf mistletoe. Percent infection (percentage of acreage having one or more trees per acre infected) varies by forest type, ranging from 5.2% in the Douglas-fir type, to 34.5% in the ponderosa pine type.

The presence of dwarf mistletoe in forest stands may adversely affect stand management objectives. Losses from dwarf mistletoe take the form of reduced height and diameter growth of moderately to heavily infected trees, reduced value due to poor wood quality, increased mortality of heavily infected trees, deformation of trees, and reduced cone crops. Estimates for height growth reductions for ponderosa pine are as high as 50% of normal growth for heavily infected trees (Hawksworth et al. 1991). Significant reduction in yields of stands occurs if they are infested early in their development and if no suppression measures are taken to reduce the spread and intensity of the disease. The combined effects of mistletoe and cambium-feeding insects most often cause tree mortality. Additional stress factors such as overstocking and drought increase the likelihood of mortality. During drought periods, dwarf mistletoe-infected trees are often the first to die. During the 1976-79 drought, 50 to 75% of the pines that died were infected with dwarf mistletoe (Byler 1978).

Stand management treatments are the most important factor governing the distribution and effects of dwarf mistletoes in ecosystems. Partial cutting generally intensifies the parasite in residual trees (Hawksworth 1961). Many of the severely infested stands now present are the result of past selective logging practices in which infected overstory trees were left, resulting in infection of the subsequent understory. Selection harvest creates multiple-aged or uneven-aged conditions that promote the spread of dwarf mistletoe (Barrett 1979, Seidal and Cochran 1981).

Levels of dwarf mistletoe will gradually increase in multi-storied stands. In stands comprised of susceptible trees of different sizes, the crowns of smaller trees are continually exposed to inoculum from larger trees, resulting in infection of the upper crown and reductions in growth (Parmeter 1978). This type of stand structure also results in a more rapid rate of spread of the dwarf mistletoe than through single-storied stands. Thus, in mistletoe-infested stands, any silvicultural system which intermixes generations or sizes of susceptible host trees will favor dwarf mistletoe infestation and spread.

The removal of infested trees is the preferred method of reducing dwarf mistletoe impacts in moderate to severely infested stands. The openings should be large enough to remove all infected trees. An infected overstory tree, left after a regeneration cut, can provide enough dwarf mistletoe seed to infest about 1-acre of susceptible species in the understory (Parmeter and Scharpf 1972). Small openings also encourage dwarf mistletoe seed production. If the openings created are small, the trees in the openings will quickly become infected and will suffer heavy growth loss and mortality. Studies in California (Wagener 1961) suggest that partial sunlight is more favorable to the establishment of dwarf mistletoe on the host than relatively full or continuous sunshine. The number of visible plants can double within 4 years after thinning (Roth and Barrett 1985).

Removing infected trees from the stand is one option to reduce the adverse effects of dwarf mistletoes on stand management objectives. Tree removal or clear cutting may be necessary when stands are severely infected and not managed for decades. To be effective in those situations, all host trees within and immediately adjacent to infested areas need to be removed.

Root Diseases

Root diseases are common in California forests. Root diseases, such as annosus and black stain, spread locally through root systems. Silvicultural systems that involve retention of infected trees will result in continued or increased levels of infection within stands. These root pathogens tend to occur in discrete and recognizable patches within healthy stands. Removal of all host trees from root disease centers and regeneration with resistant species is a standard means of reducing the future incidence and impact of annosus and other root diseases that are interfering with management objectives (Hessberg et al. 1995, Otrosina and Scharpf 1989).

Annosus root disease is caused by *Heterobasidion annosum*, an extensively distributed pathogen responsible for high levels of mortality, especially during periods of drought stress, when it can weaken trees sufficiently so that successful beetle attacks result in mortality (CFPC 1988; Smith 1984; Otrosina and Scharpf 1989). Adverse effects include mortality, reduction of vegetative cover, and creation of hazard trees. Two strains are present: one that infects true firs, Douglas-fir, giant sequoia, spruce, and hemlock, and one that infects pines, incense cedar, western juniper, and hardwoods. The strain in true fir results in root and heartwood rot, while the strain in pine often causes mortality through girdling. Spread of the disease is through airborne spores or through root-to-root contact between infected and uninfected trees. Incidences of disease increase with multiple logging entries, generally as a result of residual tree damage or presence of stumps untreated with borax, which allow spore entry.

Sudden Oak Death (Caused by *Phytophthora ramorum*)

This pathogen has caused localized intensive mortality in tanoaks and coast live oaks within the Coast Range. However, this recently discovered disease is not yet a Sierran forest problem. Host species found in the Sierra Nevada include Douglas-fir, black oak, bigleaf maple, madrone, tanoak, and California laurel. Neither the method of spread of the pathogen, its requirements for successful infection, nor the conditions conducive to tree mortality are clearly understood. For these reasons, its potential to spread into the Sierra Nevada is unknown. Surveys for signs and symptoms are continuing.

Air Pollution (Ozone injury)

In studies in Southern California, on forest species similar to those of the Sierra Nevada, high levels of ozone exposure have resulted in development of chlorotic, sparse foliage, and reduced exudation of defensive resin in response to bark beetle attack, increasing the risk of successful attack by bark beetles (Ferrell 1996).

Vegetation Density, Composition, Insects/Pathogens and Vegetation Management

Active vegetation management, including mechanical removal of trees, hand cutting, or prescribed burning, is important for restoring and maintaining forest health, particularly in eastside pine, westside ponderosa pine, and mixed conifer forests. Vegetation management can effectively be used to reduce vegetation density and modify species composition, thereby indirectly countering drought and reducing insect/pathogen mortality. Vegetation management can also be used to regulate species composition and reduce insect/pathogen mortality through selective removal of infected trees and reforestation with pest-resistant species. The type of vegetation management that is most effective and appropriate is dependent upon the specific management objectives and site conditions.

Although both mechanical thinning and prescribed fire can reduce forest density, effects vary. Prescribed burning can be relatively inexpensive to implement, but can cause air quality impacts and may not always achieve desired structural or compositional objectives. For example, prescribed burning may lead to high levels of mortality in tree species having relatively thin bark. Efforts to cause mortality in trees with thick bark through the use of a "hot" prescribed fire may damage desirable trees or consume substantial amounts of duff and down logs. In another example, dense understory trees may form a *fuel ladder*, allowing fire burning through the understory to torch crowns of the taller trees. Further, burning where large, old pines have large accumulations of duff and bark at their bases can increase the likelihood of cambium damage and potential mortality—although modifying firing patterns and other burning protocols can sometimes prevent these effects.

Desired spatial distribution of residual trees can usually be attained by mechanical methods. However, mechanical treatments can result in increased incidence of pathogens and insects through creation of host sites on stumps or in slash—although these effects can also often be mitigated. Mechanical treatments can cause soil compaction. Both mechanical and fire treatments can expose mineral soil, which provides a seedbed for natural tree reproduction and an opportunity for herbaceous and shrub growth.

Economic factors differ between the prescribed burning and mechanical treatment. On steeper slopes, it may be economically impractical to conduct extensive mechanical thinning.

Suitability of these two vegetation management treatments varies by ecosystem or forest type as well. In general, the condition of most of the eastside forests requires mechanical treatment in the first step in forest health restoration. Dense thickets of pine are difficult to burn and achieve all of the desired structural conditions. In addition, soil nutrient processes are more sensitive in eastside forests, and fires intense enough to decrease density may result in unwanted losses of soil productivity. In the more productive westside forests, the tradeoffs are different and depend more upon site-specific stand structure. In upper montane red fir forests, the changes in forest structure and composition since European settlement have been less severe and, therefore, the need to conduct restoration management for forest health is less urgent.

Stands that are managed to have moderate tree density will result in reduced mortality of large diameter trees and an increased number of mid-diameter trees, which are available to grow into larger diameter trees. Selecting for diversity of residual tree species during thinning is desired, because bark beetles are fairly host-specific, and species diversity usually guarantees that some trees remain alive during elevated stress periods. Removing competing vegetation from plantations will reduce the susceptibility to various insects that often cause damage to regeneration.

Regeneration

In many forested areas, existing species composition does not conform to that desired. In a planted area, the chosen species distribution is likely to persist, provided that cultural practices are employed to minimize the adverse effects of competing plants and other adverse forces. Natural regeneration is less likely to provide the target composition, especially when shade-tolerant species are common and/or the environmental conditions are not favorable for growth of shade-intolerant species. For example, white fir and/or incense cedar commonly dominate regeneration in moderately dense stands or small openings. Species that are less shade-tolerant, e.g. ponderosa pine and sugar pine, are more likely to successfully establish in openings larger than 0.5 acres.

In general, under residual trees, soil moisture and light are less available to young seedlings than in openings. These limitations reduce growth rates of all conifer species but have the greatest impact on growth and survival of shade-intolerant species such as ponderosa pine and black oak. Under residual trees, the environmental regime of relatively cool soil surface temperatures and short intervals of overhead light favor the more shade-tolerant species, allowing white fir, incense cedar, sugar pine, and Douglas-fir to become dominant. In a productive, mixed conifer stand in northern California, managed by a single-tree selection method (where a high level of residual trees was present), Lilieholm (1990) observed that while seedlings of all species of the mixed conifer forest type were present, shade-intolerant pines were virtually absent from the small and large-sapling classes, and white fir and Douglas-fir comprised over 85% of the large-sapling class.

Residual overstory trees affect the seedling environment by casting shade, which moderates temperature extremes. Summer temperatures may be reduced by as much as 10° F, and winter extremes may be warmer by a similar amount (Geiger 1966). However, other than occasional sunflecks, the sun shines in canopy openings only when it is directly overhead. Shade-intolerant species, such as ponderosa pine and black oak, may become established under shade, but typically do not grow as well as more shade-tolerant species. Hence, heavier shade from residual trees in untreated and lightly thinned areas will tend to favor survival and growth of more shade-tolerant species over ponderosa and sugar pine. Shade-intolerant species grow faster in openings larger than 0.5-acre.

Despite moderating some microsite conditions, residual trees use water, competing strongly with seedlings for this limiting resource. On a good site in northern California, Ziemer (1968) measured soil moisture around an isolated 28-inch diameter sugar pine and found that soil moisture depletion extended outward a distance of slightly over 20-feet from the base of the tree and somewhat deeper than 15-feet under the tree. After thinning or other harvest that creates openings between trees, existing roots of bordering trees expand rapidly and capture additional resources. Ziemer (1964) found that roots of bordering trees extended new roots about 10-feet into newly created openings and about 30-feet into 5-year-old openings. Clearly, root competition from residual overstory trees reduces availability of moisture for young seedlings, adversely affecting survival and growth.

Residual trees may also favor increases in populations of seedling predators and pathogens, in particular dwarf mistletoe. Black-tailed deer, known to feed on young conifers, may be more numerous where residual trees provide hiding cover. Pocket gopher populations are often highest in thinned stands where the open canopy allows development of forbs. Pocket gophers are capable of consuming entire crops of young confer seedlings and have also been observed to damage much larger trees. Dwarf mistletoe (*Arceuthobium* spp.) readily spreads from taller residual trees onto young seedlings and saplings in the understory. Cooler, moist conditions under residual trees may also favor western gall rust and white pine blister rust, diseases that kill or stunt young conifers.

Existing Conditions

Three factors are used is this document to characterize existing forest and vegetation health conditions:

- vegetation density and composition and interactions with drought, insect/pathogens, and fire
- mortality levels from insects and pathogens; and
- forest regeneration.

Vegetation Density and Composition and Interactions with Drought, Insect/Pathogens, and Fire.

Current conditions of vegetation density and composition, and the associated influence on response to drought, insects/pathogens, and fire, vary with ecosystem and vegetation type in the project area. Table

3.1.1a shows change from historical conditions (pre-1850) to existing conditions (post-1950) for major characteristics of forest vegetation, including fire and insect/drought disturbances, by major landscape zone (eastside, transition, and westside), and forest type (ponderosa pine, mixed conifer, white fir, red fir, aspen, and foothill woodlands) for the Plumas and Lassen National Forests. Four different degrees of change are used: little or none, low, moderate, and high. These are relative categories, based upon a synthesis of quantitative and qualitative measures described in Fites et al. 1996.

Table 3.1.1a. Change in Vegetation from Historical Conditions.

Landscape Zone/ Forest Type	Dominant Tree Species	Typical Stand Structure	Landscape Patterns of Forest Structure	Drought/ Insect Related Tree Mortality	Fire Regime	Fire Severity/ Fire Effects
Eastside						
Ponderosa pine	Low to high	High	Moderate to high	Moderate to high	High	High
Mixed conifer (white fir-pondersoa pine)	Low to high	Moderate to high	High	Moderate to high	High	High
White fir (>6,000' elevation)	Low	Low to moderate	Low to moderate	Moderate to high	Moderate to high	Moderate to high
Aspen	High	High	High	Little or none	Moderate to high	Moderate to high
Transition						
Douglas fir/dry mixed conifer	Moderate to high	High	High	Moderate	High	High
Moist mixed conifer	Low to moderate	Moderate to high	Moderate to high	Moderate to high	Moderate to high	High
White fir (>6,000' elevation)	Low	Low to moderate	Low to moderate	Moderate to high	Moderate to high	Moderate to high
Transition & Westside						
Ponderosa pine/dry mixed conifer	Moderate or high[1]	High	High	Moderate	High	High
Red fir	Little or none/low	Low	Low to moderate	Low	Low to moderate	Low to moderate
Westside						
Moist mixed conifer	Low to moderate	Moderate	Moderate	Moderate	Moderate to high	High

[1] Moderate where it existed historically on moist sites, high where white fir expanded into historically eastside pine forests.

The combination of post-settlement human activities, harvest strategies, fire suppression, and climate change has decreased the proportion of pine within forested areas and increased stand density. These changes have resulted in a greater vulnerability to drought-related insect/pathogen mortality and high severity fire. The degree of change in westside mixed conifer has also varied in relation to aspect and position in the landscape. Table 3.1.1b summarizes the current susceptibility to insect/drought-related mortality within the analysis area, exclusive of the Humboldt-Toiyabe, by CALVEG vegetation type. Susceptibility classes are defined by Stand Density Index values for individual strata. Precipitation data was added to these values for the northeastern national forests (Fischer, unpublished file information). Table 3.1.1c summarizes the same data by forest.

Table 3.1.1b. Acres Susceptible to Insect/Drought-Related Mortality by CALVEG Vegetation Type.

CALVEG Type	Susceptibility Rating				Total
	Extreme	High	Moderate	Low	
Eastside Pine	7,559		9,875		17,434
Jeffrey Pine	14,256	3,803	18,549	270,557	307,166
Lodgepole Pine	47,820	63,678		120,246	231,745
Mixed Conifer (Fir)	439,026	363,238	263,628	307,192	1,373,083
Mixed Conifer (Pine)	413,454	235,070	107,110	151,916	907,550
Singleleaf Pinyon Juniper				95,063	95,063
Ponderosa Pine	59,485	156,082	25,235	195,783	436,585
Red Fir	237,316	28,972	144,708	151,769	562,766
White Fir	34,397	33,926	39,773	43,134	151,229
Total (in acres)	**1,253,312**	**884,770**	**608,878**	**1,335,661**	**4,082,621**

(Source: Fisher, unpublished file data 2003)

Table 3.1.1c. Risk of Insect/Drought-Related Mortality by Forest.

National Forest Unit	Susceptibility Rating				Total
	Extreme	High	Moderate	Low	
Lassen National Forest	51,319	75,171		114,998	241,488
Modoc National Forest	77,483	85,370		29,385	192,238
Plumas National Forest	64,770	55,262		117,636	237,668
Tahoe National Forest	96,828	92,056	126,043	81,186	396,113
Lake Tahoe Basin Management Unit	13,069	9,095	49,799	79,673	151,636
Stanislaus National Forest	249,344	184,155	217,059	48,969	699,527
Sequoia National Forest	78,387	171,537	321,682	85,904	657,511
Sierra National Forest	265,717	161,767	255,076	26,010	708,571
Inyo National Forest	26,905	22,295	184,806		234,006
Eldorado National Forest	329,490	28,061	181,195	25,116	563,863

(Source: Fisher, unpublished file data 2003)

On the Eldorado National Forest, reconstructions of changes in forest composition indicate that large changes occurred on the dry sites, once pine-dominated and now increasingly fir and cedar-dominated, but fewer changes occurred on the more mesic sites (Fites-Kaufman 1997). On north and east aspects, composition has apparently changed less, with Douglas-fir and white fir having always been more common.

In eastside mixed conifer forests in the Lake Tahoe region, changes in composition and density have been substantial (Barbour et al. 2002). Stem density in the understory has increased, primarily with white fir proliferation. In the southern Sierra Nevada, the degree of change has varied with precipitation level and site productivity. Jeffrey pine forests on the drier and lower-productivity sites have undergone density increases, but they are not as great as on the more productive sites having higher precipitation (Minich et al. 1995).

Mortality Levels from Insects and Pathogens

Insects

As a result of the protracted dry period in the late 1980’s and the early 1990’s, many stands throughout the Sierra Nevada sustained elevated levels of bark beetle-related mortality. An estimated 2 billion board feet of timber were lost. The most severe mortality was confined to the eastside forests, typically in areas that normally receive less than 40 inches of annual precipitation. Factors that contributed to the high levels of mortality in these areas included the following:

- For some species, stocking levels are higher than some sites can sustain through protracted dry periods.
- White fir is currently much more prevalent at lower elevations than likely existed prior to European settlement.
- Red and white fir are present in areas, which under normal conditions, receive precipitation that is near the lower limit for these species.

These conditions do not lend themselves well to withstanding the frequent occurrence of below-normal precipitation periods that are common in California. When normal or above-normal precipitation is not received, species growing in these areas become drought stressed. The condition is exacerbated by overstocked growing conditions. Trees growing in areas that receive less than their optimal precipitation level are more susceptible to insects, particularly bark beetles, pathogens, and weather-related disturbances.

After the drought in the mid 1970's, mortality totaled about 13.4 million trees, with a commercial volume of 9.6 billion board feet (combined mortality 1975-1979 on 6.3 million acres of commercial forest land in 12 national forests in northern California). Most of this (52% of the trees killed and 66% of the volume) occurred in the westside mixed conifer forests. Distribution of mortality across areas of different site quality did not show a pattern in terms of trees per acre; however, in terms of volume, the higher quality site had much higher volumes of dead trees. Mortality rates during this period (1975-1979) represented an increase in mortality 15-20 times the non-drought levels of mortality. In the early part of the drought, mortality was concentrated in the low elevation ponderosa pine type; as the drought progressed, mortality increased in the mid-to-upper elevation mixed conifer and fir types. Much of the mortality was concentrated in large-diameter pines.

Blister Rust

Blister rust is prevalent throughout many of the sugar pine and high elevation white pine stands of the Sierra Nevada. This disease is likely altering size/class distributions of sugar pine and limiting regeneration. Damage potential is severe for high-elevation species, including whitebark and limber pines. An active program for breeding white pine blister rust resistance is in place in California, primarily focusing on sugar pine. Genetically resistant sugar pines have been identified on the national forests. The proportion of sugar pine resistant to the rust is low and ranges from about 1% on the Modoc National Forest to about 8% on the Sequoia National Forest. Seed from these trees can provide a source of genetically-resistant sugar pine seedlings.

Dwarf Mistletoe

Recent treatments to control dwarf mistletoe typically involved removing infected overstory trees and regenerating sites with non-host trees (which is made possible because of the species selectivity of the various mistletoes). An estimated one-quarter of the ponderosa pines on the Pacific Coast are infested. About 25% of the commercial national forest land in the Sierra Nevada is infested. Partial cutting, including the retention of infested overstory trees, and uneven-aged management generally intensifies the level of this parasite in residual trees.

Black Stain Root Disease

Black stain root disease (caused by *Leptographium wageneri*) in common throughout the Sierra Nevada and is especially common and damaging in overstocked pine stands on the Modoc National Forest (Kliejunas 1992), portions of the Lassen National Forest, and in the Georgetown Divide area of the central Sierra National Forest (Byler et al. 1979). Mortality of singleleaf pinyon pine caused by black stain root disease occurs over 20,000 to 30,000 acres of BLM lands east of the Sierra Nevada crest (Smith 1983b), resulting in extreme fire hazard due to increased fuel loads.

Annosus Root Disease

The pathogen causing annosus root disease (*Heterobasidion annosum*) affects two million acres of commercial forest land in the Sierra Nevada and results in annual volume losses of about 19.3 million cubic feet (CFPC 1988). A 1979-1980 survey (Slaughter and Parmeter 1989) estimated that 4% (1.46 billion board feet) of the live true fir in 12 national forests in central and northern California was infested by the pathogen. An estimated 586,000 acres in 12 national forests of northern California is infested with the root disease (DeNitto et al. 1984). Annosus root disease is widespread in eastside pine.

A current estimate is that 4% of true fir stands is infected (CFPC 1988). Infection is widespread in eastside pine types. This pathogen results in a growth loss estimated at 19 million cubic feet. Proportions of pine stumps infected were 50% on the Modoc National Forest, 10% on the Lassen National Forest, 22% on the Plumas National Forest, 14% on the Tahoe National Forest, and 20% on the Inyo National Forest (Kliejunas 1989a, Kliejunas 1989b, Pronos and Harris 1991).

Air Pollution (Ozone Injury)

The first report of ozone injury to pines in the Sierra Nevada was in 1971. Since 1971, surveys based on foliar symptoms (chlorotic mottle) have documented that ozone injury is present throughout the Sierra Nevada, with a gradient of increasing injury from north to south. As yet, no pronounced increases in tree mortality have been attributed to this cause.

Forest Regeneration

On unmanaged landscapes, conifers establish through natural seeding, usually from freshly fallen seed from nearby trees. In general, conifers common to the Sierra Nevada do not sprout following fire or cutting and do not emerge from a persistent seed bank accumulated in the soil. Conifers are commonly replanted on managed landscapes, following regeneration timber harvest or other disturbance such as stand-replacing wildfire or insect-caused tree mortality.

Conifer seed crops are highly irregular and unpredictable. Several years commonly pass between crops, with essentially no seed produced for several years. In a given year, some species may produce a seed crop while others do not. Numerous factors affect successful germination and seedling establishment, including:

- proximity to seed source (distance, topographic location);
- adequacy of seed crop;
- location of seed source relative to prevailing winds;
- seedbed type and condition (mineral soil, organic matter);
- microsite conditions;
- presence of seed predators, insects, and disease; and
- available soil moisture.

Once seedlings are established, their persistence in the environment is not assured. Additional challenges facing seedlings include:

- competition (inter- and intra-specific);
- adequacy of sunlight for growth (needs vary by species);
- suitability of air and soil temperatures;
- predation (deer, pocket gophers);

- presence of insects and pathogens;
- adequacy of soil moisture; and
- physical hazards (trampling, crushing, burying, fire).

Assuming that seed sources for a mix of conifer species are locally available (or that a mix of species is planted), differential effects of the above factors through time will determine the ultimate composition of seedling and sapling recruitment into mature stands.

3.1.3. Fire and Fuels

Background

The SNFPA FEIS summarized findings from the Sierra Nevada Ecosystem Project (SNEP 1996) related to fire, fuels, and fire management in the Sierra Nevada (FEIS, volume 2, chapter 3, pages 238-240), to stress the point that "understanding past and present roles of fire in shaping Sierra Nevada ecosystems is critical for managing fire and fuels. Fire, once a pervasive force in structuring and rejuvenating Sierra ecosystems, is now intensively managed."

Fire as an Ecological Force

Fire has been an important ecosystem process in the Sierra Nevada for thousands of years. Before the area was settled in the 1850's, fires were generally frequent throughout much of the range. The frequency and severity of these fires varied spatially and temporally depending upon climate, elevation, topography, vegetation, edaphic conditions, and human cultural practices. Because fire was so prevalent in the centuries before extensive Euro-American settlement (pre-settlement), many common plants exhibit specific fire-adapted traits, such as thick bark and fire-stimulated flowering, sprouting, and seed release and/or germination (Chang 1996). In addition, fire affected the dynamics of biomass accumulation and nutrient cycling, and generated vegetation mosaics at a variety of spatial scales (Chang 1996). Because fire influenced the dynamics of nearly all ecological processes, reduction of the influence of fire in these ecosystems because of fire suppression in the twentieth century has had widespread (though not yet completely understood) effects.

Current management strategies and those of the immediate past have contributed to forest conditions that encourage high-severity fires. The policy of excluding all fires has been successful in generally eliminating fires of low to moderate severity as a significant ecological process. However, current technology is not capable of eliminating high-severity fires. Thus, fires that affect significant portions of the landscape, which once varied considerably in severity, are now almost exclusively high-severity, large, stand-replacing fires.

Changes in Fuels and Fire Intensity

The dramatic reduction in area burned in the twentieth century, combined with the effects of forest management practices and generally warmer-moister climatic conditions (Graumlich 1993, Stine 1996), has almost certainly led to substantial increases in the quantity of live and dead fuels and changes their arrangement. Data from the early twentieth century are not available to test this assertion rigorously; it is based on comparisons with early conditions inferred from numerous historical accounts, documented fire histories, and structures of uncut stands (Kilgore and Sando 1975, Parsons and DeBenedetti 1979, Bonnickson and Stone 1982, van Wagtendonk 1985, Biswell 1989, Weatherspoon et al. 1992, Chang 1996, Skinner and Chang 1996, Weatherspoon and Skinner 1996). During this period, live and dead fuels generally increased, and conifer forests generally became denser. The increases in stand density were concentrated in small and medium size classes of shade-tolerant and fire-sensitive species. Lacking fire, the thinning that has occurred has been due to competition (primarily water and light), disease, and insect attack. The result has been a large increase in amount and continuity of live forest fuels near the forest floor that provide a link between the surface fuels and upper canopy layers. The lack of fire has allowed dead fuels to accumulate in excess of their pre-settlement levels.

More precisely, the assertion is that current fires burn much larger contiguous areas at high intensities, resulting in a larger proportion of the burned area suffering severe fire effects. We have no direct data to support these assertions, but, as with the increase in fuels, such a conclusion is consistent with information available from fire history studies and other sources. The frequency and extensiveness of fire that occurred in the pre-settlement era were simply too high to allow the accumulation of dead fuel and live *ladder* fuels that lead to extensive crown fires. Accounts of early surveyors explicitly state that crown fires were uncommon.

See SNFPA FEIS volume 2, section 3.5 (pages 238-306) for more information about fire, fuels, and the effects of fire in the Sierra Nevada.

New Information

Fire Policy – National Fire Plan and Comprehensive Strategy

To respond to the wildland fires in 2000, the President requested, and the Secretaries of the Interior and Agriculture submitted, an assessment entitled *Managing the Impact of Wildfires on Communities and the Environment, A Report to the President in Response to the Wildfires of 2000* (September 8, 2000). This report, a subsequent Forest Service report entitled *Protecting People and Sustaining Resources in Fire-Apdapted Ecosytems: a Cohesive Strategy*, simultaneous budget requests, congressional direction for substantial new appropriations for wildland fire management for fiscal year 2001 and 2002, and resulting action plans and agency strategies have collectively become known as the National Fire Plan (NFP). The NFP has broad support with the present (and previous) administration, Congress, western states governors, and many other local and regional groups.

The NFP includes a discussion of national priority setting, funding allocations and accomplishments, and accountability mechanisms. The NFP serves as a clearinghouse with links to other bi-partisan federal, state, tribal, and local fire management policies and funding initiatives. In August of 2001, the Secretaries of Agriculture and Interior, and by the Western State Governors Association developed a companion document entitled *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, 10-Year Comprehensive Strategy* (Comprehensive Strategy). This document defined the core principles and goals of the Comprehensive Strategy. In May of 2002, the secretaries and governors developed the *Implementation Plan for the Comprehensive Strategy*. This presentation of a 10-year strategy is the latest and most specific NFP document available. This element of the NFP had not been completed at the time the SNFPA FEIS ROD was signed (January 2001).

The NFP has evolved over the last two years from the USDA Forest Service's original Cohesive Strategy to the finalization of the Implementation Plan. The ability of the forests to implement an effective strategy for reduction of hazardous fuels at the landscape level is the fundamental issue for effective implementation of this plan. The Regional Forester of Region 5 supports the performance measures outlined in the Implementation Plan, which can be used to evaluate successful outcomes. Federal, state, tribal, and local governments have endorsed the four goals of the Comprehensive Strategy. Forest Service units at the state and local levels are working collaboratively with other agencies to accomplish the defined implementation outcomes by specified dates.

Implementation Outcome for Goal 1 - Improve Fire Prevention and Suppression

Desired outcome: losses of life are eliminated, and firefighter injuries and damage to communities and the environment from severe, unplanned, and unwanted wildland fires are reduced.

One of the measures of success (performance measure) in attaining this goal is the number of acres burned with high severity by unplanned and unwanted wildland fires. While this performance measure is strongly dependent upon developing and maintaining an efficient and well-trained suppression organization with improved prevention programs, it is also inextricably linked to implementing a successful strategy to reduce hazardous fuels across the landscape. Successful performance is influenced by the ability to reduce hazardous fuels so as to significantly lower wildfire intensity and rate of spread, thus directly contributing to more effective suppression efforts and reducing acreage burned.

Implementation Outcome for Goal 2 - Reduce Hazardous Fuels

Desired outcome: Hazardous fuels are treated, using appropriate tools, to reduce the risk of unplanned and unwanted wildland fire to communities and to the environment.

The acreage treated and acreage treated per million dollars of gross investment in targeted areas are two performance measures for this goal.

Table 3.1.3a shows that hazardous fuel treatment in the Sierra Nevada bioregion has increased substantially since 1995 with a significant increase following the increased funding from the NFP.

Table 3.1.3a. Hazardous Fuels Treatments in the Sierra-Nevada Bioregion, FY 1995-2003 (to nearest thousand acres).

Year	Acreage Treated
FY 1995	14,000
FY 1996	17,000
FY 1997	25,000
FY 1998	45,000
FY 1999	51,000
FY 2000	51,000
FY 2001	81,000
FY 2002	58,000
FY 2003	75,000

(Source: USDA Forest Service 2003d)

Implementation Outcome for Goal 3 - Restore Fire-Adapted Ecosystems

Desired outcome: fire-adapted ecosystems are restored, rehabilitated, and maintained, using appropriate tools, in a manner that will provide sustainable environmental, social, and economic benefits.

Performance measures for this goal include the high-priority acreage moved to a better condition class (both total acreage moved and percent moved of total acres treated). Progress in the accomplishment of this goal is a key component of the Regional Forester's performance.

Condition Classes 2 and 3 are the targets for treatment. Condition Class 2 is composed of lands where fire regimes have been altered from their historic ranges, creating a moderate risk of losing key ecosystem components as a result of wildfire. The vegetative composition, structure, and diversity of lands in Condition Class 3 have been significantly altered due to multiple missing fire return intervals. These lands "verge on the greatest risk of ecological collapse."

The current estimate of acreage in Condition Classes 2 and 3 across the Sierra Nevada national forests is over 7 million acres. Of this amount, about 3 million acres are estimated to be in Condition Class 3. A map of condition class covering national forests of the Sierra Nevada is available on the Internet from the California Department of Forestry and Fire Protection at frap.cdf.ca.gov/data/frapgismaps/select.asp.

Table 3.1.3b displays the approximate acreage in each condition class for each national forest in the Sierra Nevada. Some areas on each forest are not managed as wildland and therefore do not fit in a condition class. These areas are grouped under "NA." This information is provided to give a general idea of the relative mix of condition class on each forest, but it is constantly changing as a result of ongoing local assessments.

Table 3.1.3b. Fuel Condition Class by Forest.

National Forest	Average by Condition Class				Total Acreage
	1	2	3	NA[1]	
Eldorado	123,555	254,005	158,624	62,253	598,437
Inyo	595,662	415,016	613,044	302,081	1,925,804
Lassen	180,330	324,585	623,645	20,920	1,149,480
LTBMU	34,797	39,942	37,135	5,320	117,195
Modoc	102,208	543,785	973,954	56,518	1,676,464
Plumas	150,930	258,403	767,193	26,015	1,202,541
Sequoia	242,425	417,803	399,068	52,048	1,111,344
Sierra	368,432	445,672	319,478	186,350	1,319,931
Stanislaus	218,545	338,043	218,846	121,939	897,373
Tahoe	159,240	318,143	304,350	43,347	825,080
Toiyabe	110,607	174,595	219,108	135,374	639,684
Total	**2,286,732**	**3,529,994**	**4,634,448**	**1,012,165**	**11,463,333**

[1] *Not applicable; area not rated as constituting wildland or fuel. (Source: USDA Forest Service 2003d)*

The NFP required each national forest to develop a fire management plan identifying appropriate management response and use of fire as integral components of its fire and fuels management strategy. The SNFPA ROD amended the forest plans for national forests of the Sierra Nevada to allow line officers to manage wildland fires to meet resource benefits. Since the decision, a number of forests, including the Sequoia, Sierra, Stanislaus, Inyo, and Modoc National Forests, have successfully implemented a fire use strategy.

Implementation Outcome for Goal 4 - Promote Community Assistance

Desired outcome: communities at risk have an increased capacity to prevent losses from wildland fire and the potential to seek economic opportunities resulting from treatments and services.

One performance measure for this goal is the percentage of acreage treated to reduce hazardous fuels by mechanical means with which by-products are utilized.

Community protection in the Sierra Nevada has become a multi-funded interagency collaborative strategy. In fiscal year 2002, approximately two million dollars were distributed to communities throughout the Sierra Nevada to treat hazardous fuels near national forest system lands. Additional funding is also available to communities to develop fire protection strategies.

The NFP FIREWISE program, highlighting homeowner actions and responsibilities awareness, and the state and private assistance arm of the Forest Service have additional programs and resources to help accomplish Goal 4 of the NFP. For example, numerous communities and counties now have active *firesafe councils*, and three FIREWISE workshops were conducted specifically for communities in the

Sierra Nevada bioregion. These workshops assisted communities in understanding the goals of the NFP and how to prepare plans that will minimize the impacts of future wildland fires. They also assisted groups in finding and applying for grants that are available to help them accomplish this goal.

Healthy Forests Restoration Act of 2003

Consistent with the National Fire Plan, and the Comprehensive Strategy, recent legislation titled the Healthy Forests Restoration Act of 2003 was enacted. The SNFPA and this Supplemental EIS are consistent in their design to carry out the hazardous fuel reduction direction in these Plans, Strategies, Initiatives and Laws. On December 3, 2003, HR 1904, the Healthy Forests Restoration Act of 2003 was signed into law. The legislation provides new tools and additional authorities to treat more acres more quickly. The Act is intended to help expedite projects aimed at restoring forest and rangeland health by providing streamlined administrative decisions and provide courts direction when reviewing fuel reduction or forest health projects.

- The legislation generally:
    1. Strengthens public participation in developing high priority forest health projects.
    2. Reduces the complexity of environmental analysis.
    3. Provides a more effective appeals process that encourages up-front public participation in project planning.
    4. Instructs the courts to balance the short and long term effects of projects before issuing injunctions (balance of harms) and limits the length of court injunctions while urging expedited review of lawsuits filed against forest health projects.
- Specifically the legislation:
    5. Allows hazardous fuel reduction through various methods including thinning and prescribed fire on up to 20 million acres of Federal land.
    6. States that any activity within old-growth stands must fully maintain or contribute toward maintaining the integrity of old growth stands according to forest type.
    7. Focuses tree removal activities outside old-growth acres on small diameter trees and leaving larger trees, as appropriate, for the forest type to promote fire resistant forests.
    8. Instructs the Secretaries to develop project priorities considering recommendations from community wildfire protection plans, and directs overall that not less than 50% of the funds allocated for projects be used in the wildland urban interface.
    9. Addresses the need for an early warning system for potential threats to forests from insects, disease, fire and weather related risks to increase the likelihood of successful prevention and treatment.
    10. The alternatives being considered in this SEIS are consistent with the goals and expectations of the Forest Health Initiative. Adoption of the proposed changes (Alternative S2) would not inhibit moving forward with the initiative as planned.

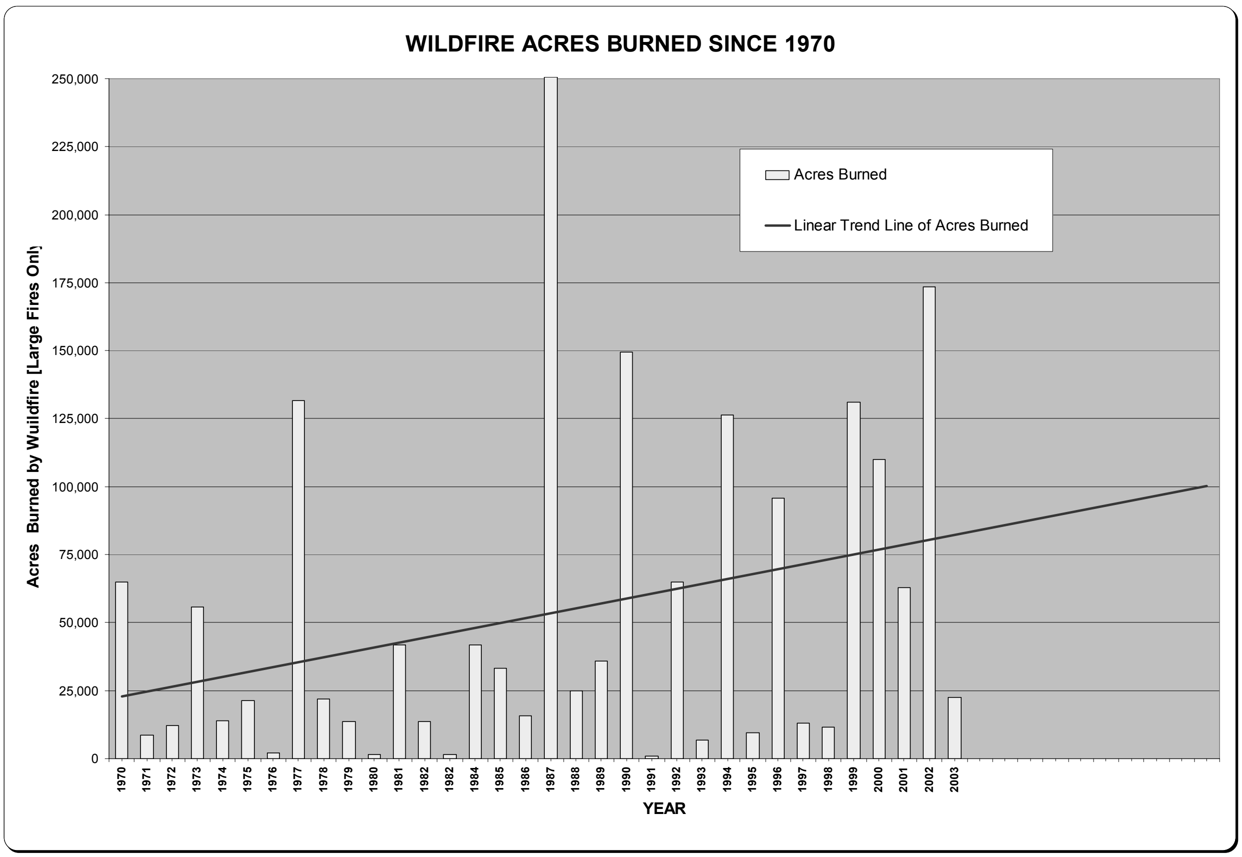
Wildfire Acres Burned

Figure 3.1.3a shows acreages of national forests in the Sierra Nevada bioregion that burned in wildfires each year from 1970 to 2003. Seven extreme years are evident in which burned acreages exceeded 10,000 acres: 1977, 1987, 1990, 1994, 1999, 2000 and 2002. The linear trend line for this highly variable annual data begins near 24,000 acres in 1970 and increases to about 80,000 acres in 2002.

This trend line suggests that more acreage is burning now than in the past and that this trend is likely to continue in the absence of some intervention. In three of the five years, a larger acreage has burned than the trend line would suggest.

Projecting wildfire acreage into the future is laden with uncertainty (see the uncertainty discussion in chapter 2 of this document and SNFPA FEIS volume 2, chapter 3, part 3.5, pages 279-281). However, the available information supports an upward trend in both burned acreage and biomass accumulation. The assessments in the National Fire Plan underscore these trends.

Figure 3.1.3a. Wildfire Acres Burned Since 1970.



(Source: USDA Forest Service 2003d)

Effectiveness of Fuels Treatments on Fire Behavior

The recent accumulations of biomass (both living and dead) that fuel wildfires necessitate new fuel management strategies to reduce the extent of area burned by severe fire and facilitate the reintroduction of fire as an ecological process. Many fuels treatments involve thinning smaller diameter trees or removing biomass (Weatherspoon 1996), in essence producing stands structurally similar to those thought to have been present in the pre-settlement period. Resulting forest structures were more open, less likely to support crown fire, and less likely to suffer extensive damage from severe fire. Post-treatment fire behavior is strongly affected by the quantity of surface fuels left onsite. Removal of trees necessary to open the stand, which results in increased wind and drying of the forest floor, usually induces much more severe fire behavior if slash is left untreated onsite (van Wagtendonk 1996).

The Hayman Fire in Colorado demonstrated the effectiveness of fuel treatments in modifying fire behavior (Graham and McCaffrey 2003). The Polhemus Prescribed Burn in November 2001 removed most surface fuel and pruned lower live branches from trees in a ponderosa pine forest, while maintaining a desirable overstory density. These changes were sufficient to stop the Hayman Fire when it burned into the area in June 2002. On the Manitou Experimental Forest, mechanical thinning for the Trout Creek Timber Sale reduced density in a pure pine forest and concentrated logging slash in large piles. These actions resulted in easily suppressed surface fire when the Hayman Fire burned into the area. On the other hand, all trees were killed in the Sheepnose Fuels Reduction Project within the Hayman fire. Although the removal of smaller trees prior to the fire substantially reduced stand density, large amounts of surface fuels allowed the fire to burn intensely through the stand.

In studying the effects of thinning on fire behavior, Graham et al. (1999) observed that, depending on the forest type and its structure, thinning has both positive and negative impacts on crown fire potential. Crown bulk density, surface fuel, and crown base height are primary stand characteristics that determine crown fire potential. *Thinning from below*, *free thinning*, and *reserve tree shelterwood harvesting*[1] have the greatest opportunity for reducing the risk of crown fire. The best general approach for reducing wildfire damage seems to involve management of tree density and species composition at a landscape scale, using well-designed silvicultural systems that include a mix of thinning, surface fuel treatment, and prescribed fire, with proactive treatment in areas having high fire risk.

Results from a study of four large fires, where fuel treatments had been accomplished prior to the fires, unanimously indicate that, under similar weather and topographic conditions, treated stands experience lower fire severity than untreated stands (Omi and Martinson 2002). Correlations between fire severity indicators and measures of crown fire hazard and fire resistance were generally good; however, individual sites provided unique lessons that illustrate the importance of treating fuel profiles in their entirety. The researchers recognized the importance of treating both the surface fuels and the ladder fuels, stating, that “while surface fire intensity is a critical factor in crown fire initiation, height to crown, the vertical continuity between fuel strata, is equally important. Further, crown fire propagation is dependent on the abundance and horizontal continuity of canopy fuels.”

Wildland-Urban Intermix

A key component of the fire and fuels strategy in all of the FEIS alternatives is an aggressive fuel treatment program in the *wildland-urban intermix* (WUI) (see SNFPA FEIS, volume 2, part 3.5, pages 284-285). The WUI is the zone where structures and other human development meet or intermingle with undeveloped wildland. The width of the zone is based on the distribution of developments, likely rates of fire spread, strategic landscape features such as roads, distribution of fuels types, and topography. To assess environmental consequences, the wildland urban intermix zone was estimated for the SNFPA FEIS using a density criteria for establishing an urban core and establishing a zone around the urban core to be an estimate of the WUI. A width of 1½ mile for this zone was estimated. WUIs are comprised of two separate buffers: an inner *defense zone* (estimated to be typically 0.25 mile wide) and an outer *threat zone* around the defense zone (estimated to be typically 1.25 miles wide). These modeled zones were subsequently reviewed and maps were modified.

[1] *Thinning from below* involves removal of the smaller trees in a stand. *Free thinning* provides for removing trees from all size classes. *Reserve tree shelterwood harvesting* involves leaving a specified number of trees in a stand to provide shade and a seed source to create a regenerated stand.

The actual boundaries will be determined at the project level. Local fire management specialists will determine the extent, treatment orientation, and prescriptions for each WUI based on historical fire spread and intensity. Actual defense zones should be of sufficient extent so that with fuel treatments within them will reduce wildland fire spread and intensity sufficiently for suppression forces to succeed in protecting the WUI. Defense zones are treated to largely eliminate the potential for fire to spread. Threat zones buffer defense zones. Actual extents of threat zones are based on fire history, local fuel conditions, weather, topography, existing and proposed fuel treatments, and natural barriers to fire.

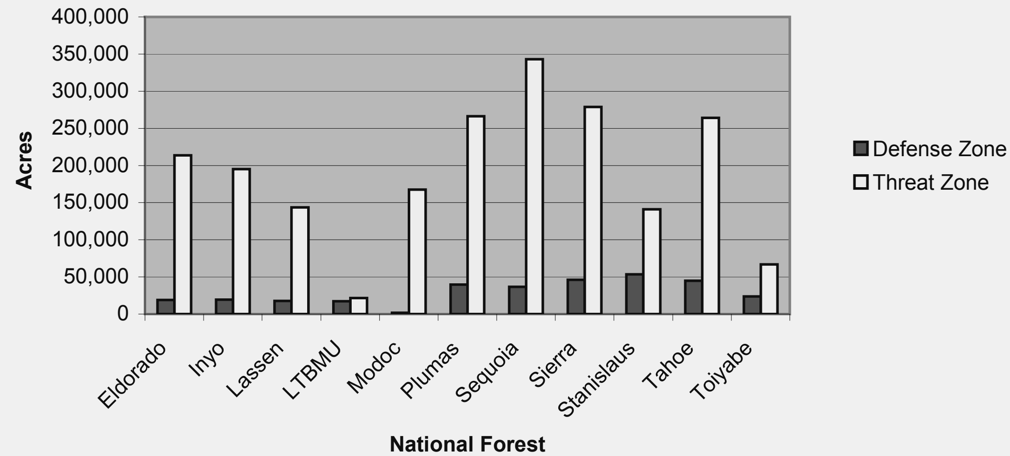
Table 3.1.3c and figures 3.1.3b and 3.1.3c display the most current acreage of modeled and locally determined WUIs for each national forest in the Sierra Nevada. These acreages are applicable to all SEIS alternatives. Of the total WUI acreage of 2.42 million acres, about 13% is in defense zones and 87% is in threat zones. Current WUI mapping is based on rules for distance around communities of concern, some local mapping of distances around collaboratively determined areas of concern, and some mapping using fire behavior predictions to determine the most appropriate areas for treatment to protect collaboratively determined areas of concern.

Table 3.1.3c. Wildland Urban Intermix Acreages (Defense and Threat zones) by Forest.

National Forest	Urban Core Acreage	Defense Zones		Threat Zones		Total WUI Acreage	Total Non-WUI Acreage	Total National Forest Acreage
		Acreage	Percent of WUI	Acreage	Percent of WUI			
Eldorado	133	19,048	8%	213,530	92%	232,578	365,859	598,437
Inyo	3,083	19,293	9%	194,957	91%	214,250	1,711,553	1,925,803
Lassen	-	17,859	11%	143,825	89%	161,684	987,796	1,149,480
LTBMU	1,958	17,205	44%	21,692	56%	38,897	78,298	117,195
Modoc	164	1,586	1%	167,350	99%	168,936	1,507,528	1,676,464
Plumas	3,472	39,537	13%	266,298	87%	305,835	896,706	1,202,541
Sequoia	2,634	36,704	10%	343,050	90%	379,754	731,590	1,111,344
Sierra	5,996	45,967	14%	278,611	86%	324,578	995,353	1,319,931
Stanislaus	2,639	53,683	28%	141,305	72%	194,988	702,385	897,373
Tahoe	1,691	44,730	14%	263,949	86%	308,679	516,401	825,080
Toiyabe	-	23,593	26%	66,902	74%	90,495	549,189	639,684
Total	**21,799**	**319,204**	**13%**	**2,101,470**	**87%**	**2,420,674**	**9,042,658**	**11,463,332**

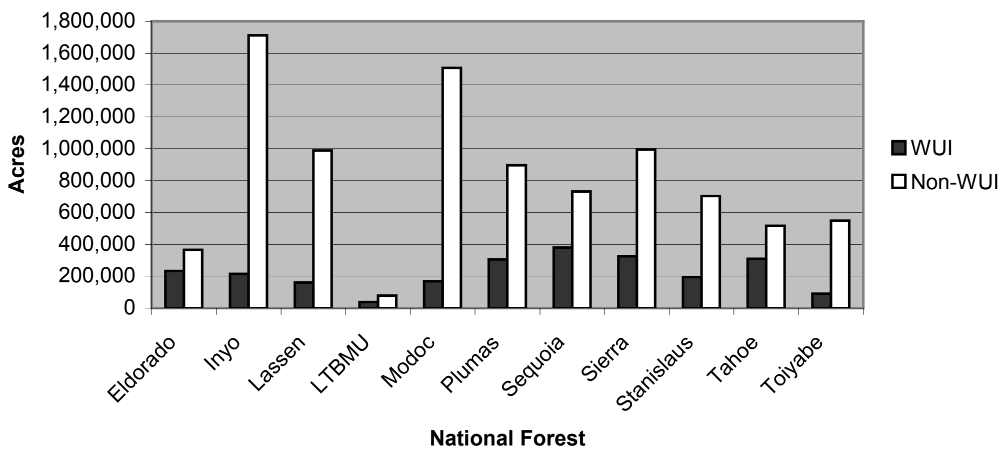
(Source: USDA Forest Service 2003d)

Figure 3.1.3b. Extent of Defense and Threat Zones by Forest



(Source: USDA Forest Service 2003d)

Figure 3.1.3c. WUI/Non-WUI Acreage by Forest



(Source: USDA Forest Service 2003d)

Fire Intensity

Fire intensity effects on forested vegetation are described by three categories: lethal, mixed-lethal, and non-lethal. In non-lethal fires, only the youngest and smallest trees that are the least fire-tolerant are killed. As fires burn with increasing intensity, a mosaic of different mortality levels develops (mixed-lethal fires). Where tree species are fire-adapted, or are larger and more resilient to fire, less mortality occurs; other areas may experience higher levels of tree mortality. Lethal fires are those that are stand-replacing events, where most or all of the vegetation is killed.

Wildland fire intensity varies, influenced by fuel characteristics, fuel moisture, wind, topography, time of day, and direction of fire spread. Fires burning through the night may back down a long slope and then run up the opposing slope on the following day. These conditions lead to the mosaic patterns of mortality often found after wildfires in the Sierra Nevada. The seasonality of fires also influences mortality: fires that burn during the growing period can adversely affects new growth, and late season fires, when live fuel moistures are lowest and large dead fuels contribute to fire spread, can result in more extensive mortality. Late season fires usually occur between September and November and vary from year to year. Table 3.1.3d shows historical fire intensity by vegetation type in the Sierra Nevada.

Table 3.1.3d. Distribution of Fire Intensities for Selected Vegetation Types in the Sierra Nevada.

Fire Intensity	Ponderosa Pine	Eastside Pine	Mixed Conifer	White Fir	Pinion Juniper	Black Oak	Live Oak	Blue Oak	Chaparral Shrub
Lethal	38%	42%	45%	49%	8%	5%	10%	1%	95%
Mixed-Lethal	31%	37%	21%	18%	83%	85%	60%	4%	4%
Non-lethal	30%	26%	34%	33%	9%	10%	40%	95%	1%

Note: Based on burned acreage per decade between the years 1974 and 1998 (SNFPA FEIS, volume 2, chapter 3, part 3.5, page 243). (Source: USDA Forest Service 2001a)

3.2. Species of the Sierra Nevada

This information supplements detailed information about species of the Sierra Nevada in the SNFPA FEIS (USDA Forest Service Pacific Southwest Region 2001a). For most species, information in the FEIS remains current and is used for the analysis without supplementation. For other species, information on life history, habitat relationships, and historical and current distribution was inadvertently omitted from the FEIS. It is added here to provide a more complete species profiles consistent with the background provided in the FEIS. For a few species, new information has become available since the FEIS that is relevant to assessing effects of the alternatives; such information is also provided below. Appendix C includes a review of the applicability of the analysis in the FEIS for each of the species considered and an assessment of the need for further evaluation in the SEIS.

3.2.1. Endangered, Threatened, and Proposed Species

3.2.1.1. California Red-Legged Frog (*Rana aurora draytonii*)

The information below was extracted and summarized from the *Recovery Plan for the California Red-Legged Frog (Rana aurora draytonii)* (USDI Fish and Wildlife Service 2002a) and the biological assessment for this SEIS (USDA Forest Service Pacific Southwest Region 2003a). Detailed references can be found in those documents. This section updates and supplements the information found in FEIS volume 3, chapter 3, part 4.3, pages 27-28.

Life History

The California red-legged frog generally breeds from November to March, although breeding may occur earlier in southern areas. Egg masses contain roughly 2,000-5,000 eggs. The egg mass is typically attached to vertical emergent vegetation, including bulrushes (*Scirpus* spp.) and cattails (*Typha* spp.), so that it floats on the water surface. Breeding adults are often associated with deep, still, or slow moving water and dense, shrubby riparian or emergent vegetation, however, they have also been found in shallow sections of streams without dense riparian vegetation. Tadpoles undergo metamorphosis 11 to 20 weeks after hatching, although some individuals have been observed to overwinter as tadpoles. California red-legged frogs reach sexual maturity in 2 to 3 years and may live 8 to 10 years.

Habitat Relationships

Little information about habitat relationships specific to the Sierra Nevada bioregion is available, and much of the known information comes from populations along California's coast and in the coastal mountains. Adult frogs require dense, shrubby, or emergent riparian vegetation close to deep (greater than 2.3 feet), still, or slow-moving waters. Cool water temperatures are also required. Historically, these frogs were found in the Central Valley of California along intermittent streams having some water depths of at least 2.3 feet, largely intact emergent or shoreline vegetation, an absence of introduced bullfrogs, and a preponderance of native rather than introduced fish. Dense vegetation close to the water and shading of moderately deep water appeared to be the most important habitat characteristics.

During dry periods, the California red-legged frog rarely is encountered far from water. During periods of wet weather, starting with the first rains of fall, some individuals may make overland excursions through upland habitats. Most of these overland movements occur at night. Evidence from marked and radio-tagged frogs on the San Luis Obispo County coast suggest that frog movement through upland habitats of about 1 mile are possible over the course of a wet season. Frogs have been observed to migrate long-distances between habitats along straight-lines, rather than using more circuitous corridors. The manner in which this species uses upland habitats in Sierra Nevada forest environments is not well understood. It is likely that their behavior is different in steep mountainous terrain with a dry litter and duff forest floor versus the grassy or moist conditions found in coastal areas. Studies are underway about the amount of time California red-legged frogs spend in upland habitats, patterns of use, and whether there is differential use of uplands by juveniles, subadults, and adults.

Status

A delineation of critical habitat for this threatened species was proposed on September 11, 2000 (65 FR 54892-54932), with the final rule made on March 13, 2001 (66 FR 14626-14674), which was after publication of the FEIS. On November 6, 2002, in a consent decree the U.S. District Court for the District of Columbia (Home Builders Association of Northern California v. Gale A. Norton, 01-1291) vacated and remanded the designation of critical habitat back to the Fish and Wildlife Service (FWS) with the exception of approximately 62,168 acres within Unit 5 on the Stanislaus National Forest.

Historical and Current Distribution

The historic distribution of this species was provided in the FEIS.

Presently, this species is known to occur in about 238 streams or drainages in 23 counties of central and southern California. In the Sierra Nevada, it is thought to potentially occur from Shasta to Mariposa counties at elevations up to 5,000 feet. Recent surveys indicate that the species is extremely rare or virtually extirpated in the Sierra Nevada foothills.

Based on limited survey data, national forests within this species' range have estimated the current population to be between 50-200 individuals. Population trend data for the past ten year period is virtually nonexistent, due to the lack of detections and species-specific surveys.

The California red-legged frog potentially occurs in the planning area on the Lassen, Plumas, Tahoe, Eldorado, and Stanislaus National Forests. Staffs from these national forests have surveyed for this species. The only positive identification has been on the Feather River District of the Plumas National Forest and includes two new populations.

In October 2003, a small population of California red-legged frogs was discovered in a stockpond on a private ranch in western Calaveras County. While the exact location of this population has not been publicly disclosed, it is known that this new discovery is several miles from the Stanislaus National Forest.

3.2.1.2. Least Bell's Vireo (*Vireo bellii pusillus*)

The information below was extracted and summarized from the *Draft Recovery Plan for the Least Bell's Vireo (Vireo bellii pusillus)* (USDI Fish and Wildlife Service 1986) and the biological assessment for this SEIS (USDA Forest Service Pacific Southwest Region 2003a). Detailed references can be found in those documents. This species was discussed in the FEIS in Appendix R (pages R-59-60), however, at the time of the FEIS, it was not known to occur on any of the Sierra Nevada national forests. During surveys for breeding willow flycatchers in 2003, responses from singing males were detected on a number of occasions along the South Fork of the Kern River (T. Benson, personal communication 2003).

Life History

Least Bell's vireo is a subtropical migrant, traveling 2,000 miles annually between breeding and wintering grounds. Preliminary results of studies of color-banded birds indicate that least Bell's vireo have a life span ranging to 7 years. However, a large proportion of the population dies before reaching the age of 1 year, as is typical of small migratory passerines.

Least Bell's vireos arrive on the southern California breeding grounds in mid-March to early April, with males arriving in advance of females by several days. Observations of banded birds suggest that returning adult breeders may arrive earlier than first-year birds by a few weeks. Least Bell's vireo are generally present on the breeding grounds until late September, although they may begin departing by late July. Stragglers have been noted in October and November, and occasionally individuals overwinter in California.

Predation is a major cause of nest failure in areas where nest parasitism by brown-headed cowbirds is infrequent or has been reduced by cowbird trapping programs. Most predation occurs during the egg stage. Predators likely include western scrub-jays (*Aphelocoma californica*), Cooper's hawks (*Accipter cooperii*), gopher snakes (*Pituophis melanoleucus*) and other snake species, raccoons (*Procyon lotor*), opossums (*Didelphis virginiana*), coyotes (*Canis latrans*), long-tailed weasels (*Mustela frenata)*, dusky-footed woodrat (*Neotoma fuscipes*), deer mice (*Peromyscus maniculatus*), rats (*Rattus* spp.), and domestic cats (*Felis domesticus*). Other sources of nest failure identified in various studies are human disturbance (trampling of nest or nest site, clearing of vegetation), ant infestation, rainstorms, and unknown factors.

Least Bell's vireo pairs may attempt to build as many as five nests in a breeding season, although most fledge young from only one or two nests. The likelihood of re-nesting depends on the season, the pair's previous reproductive effort, the success of previous efforts, and other factors. Few nests are initiated after mid-July.

Productivity is a measure of reproductive performance that represents the total production of offspring over all nesting attempts within a season, and is expressed on a per-pair basis. The annual average number of fledglings produced per pair has ranged from 0.9 to 4.5, with long-term averages ranging between 1.8 and 3.2. An even more encompassing measure of productivity is the number of fledglings produced per egg laid. This measure combines the effort of egg production with the probability of hatching and fledging young from those eggs, and hence it incorporates the number of nesting attempts made by pairs. Annual averages have ranged from 0.31 to 0.85 fledglings per egg at various sites, with long-term averages of 0.37 to 0.75 fledgling per egg. These ranges in these figures reflect the differential intensity of pressures such as egg predation, nestling predation, cowbird parasitism, and other sources of nest failure at those sites.

The earliest studies of color-banded least Bell's vireos suggested that they were strongly *site-tenacious*; i.e. once birds selected a breeding site, they returned to it year after year. These studies found that not only do least Bell's vireo return to the same drainage, they return to the same territory and even the same nest tree or shrub, a remarkable feat considering the amount of terrain covered during the course of migration. More recent data obtained at several additional breeding sights suggest, however, that site tenacity in least Bell's vireo may not be as strong as previously believed. Many banded birds are seen for the first time as 2-year olds and sometimes older, indicating that they have changed breeding locations during their first few years. The factors promoting a switch in breeding location are not known at this time. Habitat loss, lack of success in obtaining a mate, or mortality away from the breeding grounds may be possible causes.

Habitat Relationships

Least Bell's vireos require riparian areas to breed and typically inhabit structurally diverse woodlands along watercourses. They occur in a number of riparian habitat types, including cottonwood-willow woodlands/forests, oak woodlands, and mule fat scrub. Several investigators have attempted to identify the habitat requirements of the least Bell's vireo by comparing characteristics of occupied and unoccupied sites and have focused on two features that appear to be essential: (1) the presence of dense cover within 3-6 feet of the ground, where nests are typically placed and (2) a dense, stratified canopy, which is needed for foraging. Although least Bell's vireos typically nest in willow-dominated areas, plant species composition does not appear to be as important a determinant of nesting site selection as does habitat structure.

Although least Bell's vireos are tied to riparian habitat for nesting, they have been observed extending their activities into adjacent upland habitats. Least Bell's vireos along the edges of riparian corridors maintain territories that incorporate both upland and riparian habitat types. One study found that least Bell's vireos along the Sweetwater River in San Diego County traveled 9 to183 feet from the riparian edge to reach upland areas. Upland habitat was used primarily by foraging adults and adults foraging with fledglings; however, 35% of the pairs whose territories included upland habitat placed at least one nest there. Researchers speculated that upland vegetation, in particular laurel sumac (*Malosma laurina*) and elderberry may have provided important supplemental food resources for birds in marginal habitat. Use of upland vegetation has also been observed early in the spring when floodwaters inundate adjacent riparian habitat. Under such conditions, least Bell's vireos may nest exclusively in the nonriparian habitat.

Little is known about the least Bell's vireo's wintering habitat requirements. It is known that least Bell's vireos are not exclusively dependent on riparian habitat on the wintering grounds.

Status

The least Bell's vireo was proposed for listing on May 3, 1985, and was officially listed as *endangered* by the FWS on May 2, 1986 (51 FR 16474-16481). Although critical habitat was included in the original proposed rule, it was not included in the listing determination. Critical habitat was identified on February 2, 1994 (59 FR 4845-4867). No critical habitat exists on Sierra Nevada national forests.

Historical and Current Distribution

Historically, least Bell's vireo was widespread and abundant, ranging from interior northern California near Red Bluff (Tehama County), south through the Sacramento-San Joaquin Valleys, the Sierra Nevada foothills, and the Coast Ranges from Santa Clara County south to approximately San Fernando, Baja California, Mexico. Populations also were found in the Owens Valley, Death Valley, and at scattered oases and canyons throughout the Mojave Desert.

In the decades following 1940, extensive habitat loss coupled with brood parasitism by the brown-headed cowbird decimated least Bell's vireo populations rangewide, and the decline has been well documented. By the early 1980's, the least Bell's vireo had been extirpated from the Sacramento and San Joaquin Valleys, once the center of its breeding range. Breeding populations in northern Baja California apparently underwent similar declines during the same period. By the time the least Bell's vireo was federally listed in 1986, the statewide population was estimated at 300 pairs, with the majority concentrated in San Diego County.

Since the least Bell's vireo was federally listed, intensive cowbird removal programs have been initiated, and the species has undergone an increase almost as dramatic as its decline. While a few populations surviving the former decline have generally stabilized in size (e.g. Sweetwater, San Diego, and Santa Ynez River populations), most populations have undergone tremendous growth. For example, available census data indicate that the least Bell's vireo population in southern California increased from an estimated 300 pairs in 1986 to an estimated 1,346 pairs in 1996.

In addition to revealing population size increases, observations indicate that least Bell's vireos are expanding their range and recolonizing sites unoccupied for years or decades. Expansion is occurring both eastward in San Diego County, as birds become reestablished in the inland reaches of the coastal valleys, and northward, as birds disperse into Riverside and Ventura Counties. As populations continue to grow and least Bell's vireos disperse northward, it is anticipated that they could reestablish in the central and northern portions of their historical breeding range.

In 2003, repeated detections were made of singing male least Bell's vireos during surveys for willow flycatchers along the South Fork Kern River outside of National Forest System lands (T. Benson, personal communication 2003). Although nesting status was not determined, the presence of singing males implies that breeding may be occurring or is likely to occur in the future if adults continue to occupy the area. The extent of the local distribution of this species is not known at this time as species-specific surveys have not yet occurred.

Risk Factors

Two main risk factors influence least Bell's vireo populations: habitat loss and degradation, and nest parasitism by the brown-headed cowbird. Grinnell and Miller (1944) considered the least Bell's vireo still "common, even locally abundant under favorable conditions of habitat." However, they noted that in the "last fifteen years a noticeable decline has occurred in parts of southern California and in the Sacramento-San Joaquin Valley." That decline has been reported to continue for four more decades but now appears to have been reversed at least in southern California. Cowbird control efforts are currently occurring on the South Fork Kern Wildlife Area by the Army Corp of Engineers as a conservation measure for the southwestern willow flycatcher.

3.2.2. Forest Service Sensitive Species

3.2.2.1. Fisher (*Martes pennanti*)

This section updates and supplements the information found in the FEIS in volume 3, chapter 3, part 4.4, pages 2-6. Since publication of the FEIS, new information related to habitat use has become available.

Habitat Relationships

There is a discrepancy in the FEIS related to the desired future condition for the Southern Sierra Fisher Conservation Area (SSFCA). Page 8 of the ROD described desired future condition as follows: within each watershed, a minimum of 50% of the mature forested area is habitat of at least travel or foraging quality (presumed to have at least 40% canopy closure) and at least an additional 20% of the mature forested area is habitat of resting or denning quality (presumed to have at least 60% canopy closure). In addition, the desired future condition for forest carnivore den sites (see page 10 of the ROD) includes at least two large conifers per acre (having diameters at breast height [dbh] greater than 40") and one or more oaks per acre (greater than 20" dbh) with suitable denning cavities and greater than 80% canopy closure. The guidelines for the SSFCA (SNFPA ROD, page A-45) direct the national forests to retain vegetation over 60% of each planning watershed (outside the urban wildland intermix zone) that is classified in the California Wildlife Habitat Relationships (CWHR) system as having trees in size class 4 or larger with canopy cover of at least 60%. The former was based on a review of watersheds occupied by fisher on the Sequoia National Forest. The latter guideline was based on the composition of fisher home ranges within watershed on the Sequoia and Sierra National Forests. The desired future condition for the SSFCA is redefined in chapter 2 and the guideline is dropped based on the information summarized below.

To provide for maintenance of fisher and marten habitat, many forests have identified and manage for a habitat network and linking corridors for forest carnivores. These areas and their management vary by forest depending on habitat availability, detections, and other factors. Some of these networks have been established by forest plan amendment. All forests evaluate effects of projects on habitat connectivity for fisher during project planning.

It is clear from the available literature (Zielinski et al. in press-b, Mazzoni 2002) that canopy closure over 60% is important, and fisher preferentially select home ranges to include high proportions of dense forested habitat. From an analysis of forested habitat within planning watersheds in the SSFCA, it is clear that the majority of sub watersheds (HUC 6 at approximately 500-15,000 acres) do not have 50% of the forested area of the watershed in 60% canopy closure. There are 155 watersheds out of 239 that have at least 500 acres of dense (>60% canopy cover) habitat in CWHR size class 4 (trees 11-24" dbh) or larger. Only 46 of these watersheds meet the criteria of having 50% of the forested area in dense habitat. For watersheds with known fisher occupancy, the proportion of the watershed with dense habitat ranges from 7 to 81%. The average value for the forested proportion of a sub watershed within the SSFCA with dense habitat is 37%. From this information, it is difficult to determine a single threshold to guide landscape level management across the diverse habitats that comprise the species range.

Zielinski et al. (in press-b.) found that individual fisher home ranges had higher canopy closure than the surrounding area—the canopy closure was greater than 60% over an average of 66% of the area (the area ranged from 53% to 84%). It was implied that the percent of the landscape having 60% canopy closure at the watershed scale was less since fisher preferentially selected higher canopy closure than random sites, but habitat suitability at the landscape scale was not addressed. Mazzoni (2002) noted fisher home ranges in the Kings River Demonstration Project had a high proportion in dense habitat also, but did not address landscape patterns in her thesis. Informal analysis indicated an average of 43% of the watersheds with 60% canopy cover (47% of the area when hardwoods were added to the calculation of cover class) for the Kings River Demonstration Project (Purcell 2003). Self and Kerns (2001) indicated that fisher in northwestern California selected areas with canopy closure greater than 60% for rest sites over 60% of the time, in a study area with 50% of the area with canopy closure greater than 40%. They also noted that rest sites were selected in areas of high canopy closure (generally > 60%) and that 0.1-2 acre clumps with high canopy closure are often found within stands classified as having 25-40% canopy closure. This suggests that the current method of classifying canopy cover (generally greater than 5 acre minimum mapping units) may not provide a good measure of usable fisher habitat.

Truex (2001) noted that models based on canopy closure, large trees, and other habitat elements accurately described use of habitat by the Tule River fisher subpopulation. Habitat use by fisher on the Sierra National Forest was significantly below predicted levels based on habitat modeling. Since initial survey efforts in the early 1990's met with little success, while more current survey efforts have shown greater success, some biologists speculate that the Sequoia National Forest population is dispersing northward. Habitat modeling of the Kern Plateau underestimated population density in an area with drier, more open habitat. Self and Kerns (2001) also showed that habitat use is greater than would be predicted in open habitats, where legacy elements comprising patches of dense habitat provided suitable rest sites. The model by Truex has not been published and needs further refinement, but it could be a tool available for future use in predicting the probability of fisher presence on a landscape basis.

The percentage of landscapes having dense canopy closure and occupied by fisher varies considerably. The southern Sierra area appears to have the highest fisher density and smallest female home range size. This situation may be an indicator of higher quality habitat and, as such, current conditions in this area may suggest a better long term objective or goal for suitable fisher habitat (i.e. desired future condition). However, as acknowledged in Zielinski et al. (in press-a), the majority of the stands in the area consist of small to intermediate size trees (CWHR size class 4, 11-24 inches dbh) that are highly vulnerable to stand-replacing fire. Managing vegetation to retain high densities of small to medium sized trees at mid slope over large areas is in conflict with objectives for reducing the risk of stand-replacing wildfire and providing sustainable fisher habitat. Both Zielinski et al. (in press-b) and Self and Kerns (2001) noted that stands in the intermediate size class (CWHR 4) were highly used by fisher, but, in both studies, the trees actually used were among the largest available. Therefore, managing vegetation to retain stands of larger trees, or to retain highly variable stands with clumps of denser vegetation focused around large trees, may provide lower vulnerability to stand replacing fire while meeting fisher habitat needs over the long term. A cautious approach linked with monitoring would help resolve what appears to be a conflict between fuels management to maintain fisher habitat and conservation of habitat elements fisher appear to prefer.

There was another discrepancy in the FEIS regarding the lower boundary for the SSFCA. It was described in several places as either 3,500 feet or 4,500 feet. Zielinski et al. (in press-b) noted fisher occupancy in the Tule River study site at 3,200 feet, and Mazzoni (2002) noted occupancy in the Kings River Demonstration Project as low as 3,600 feet. Habitat at the lower elevation varies considerably from north to south, by aspect, and landform. For the most part, the woodland and forest communities frequented by fisher on the Sequoia National Forest begin at an elevation of approximately 4,000-5,000 feet. Fisher have been documented in chaparral but at a very low rate compared to rates for woodland and forest habitats. They also have been documented in red fir above 8,000 feet. The lower boundary for the SSFCA will be determined locally based upon vegetation and habitat potential, but is generally between 3,500 and 4,500 feet in black oak/ mixed conifer habitat. Delineation of the SSFCA is not intended to capture all habitats used by fisher, but to focus conservation efforts primarily on habitats that may be more important to reproduction and long-term stability of the population.

Status

On July 3, 2003, the FWS announced a 90-day finding for a petition to list a distinct population segment of fisher that includes the Sierra Nevada bioregion of the planning area (68 FR 41169-41174). In this finding, the FWS found that the petition presented substantial information that the West Coast population of the fisher may be a distinct population for which listing may be warranted. The FWS has initiated a 12-month status review to determine if the listing of this population is warranted. The 90-day finding acknowledged proposed changes in national forest management direction for the SNFPA planning area and will consider effects of whatever direction is current when the 12-month status review is completed.

The SNFPA ROD committed to the development of a conservation assessment for several forest carnivore species, including the fisher. A working group of biologists from the Forest Service, National Park Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. Completion of the conservation assessment is planned for fall 2004.

Historic and Current Distribution

Status and change monitoring of forest carnivores indicates increased detections of fisher in the Sierra National Forest over the past 5-10 years. This appears to indicate northward movement and expansion of the known fisher population in the southern Sierra. There is a strong concern that large stand replacing fires in the past two decades, primarily on the Stanislaus National Forest, may pose barriers to this northward expansion. The Regional Forester has made a commitment that the Forest Service will support and encourage reintroduction of fisher to the northern Sierra within the limitations of the Forest Service's authority.

Risk Factors

For a summary of risk factors, see the FEIS, volume 3, chapter 3,part 4.4, pages 2-10.

The 90-day FWS finding addresses trapping as a potential risk factor (68 FR 41172). This issue was not specifically identified in the FEIS. Although fishers are legally protected from trapping in California, there may be incidental effects on fisher from trapping for other legal species. Since trapping is regulated by the state and not the Forest Service, this risk factor is outside the control of the Forest Service.

3.2.2.2. Marten (*Martes americana*)

This section updates and supplements information found in the FEIS in volume 3, chapter 3, part 4.4, pages 19-35 as it relates to risk factors associated with the alternatives and distribution and habitat use for this species.

Habitat Relationships

Marten use of eastside habitats was addressed in the FEIS (volume 3, chapter 3, part 4.4, page 21). This information is reiterated here and expanded due to concern regarding effects to marten habitat in eastside pine under Alternative S2.

Marten are strongly associated with mesic, dense, old forest habitats. The majority of studies on marten habitat use have been in areas where mesic habitat is relatively abundant. Recent studies in eastside habitats (Kucera 2000) have indicated a mean canopy closure of 20% for active rest sites used by marten on the Inyo National Forest. Rest sites had high basal area and a high number of stems per acre indicating dense low cover. Home ranges for the Inyo study include a wide range of habitats from above treeline to mixed conifer but were most heavily weighted toward lodgepole pine, Jeffrey pine and red fir. Mean home range size for eastside marten (Kucera 2000) were four to five times the size of mean marten home ranges found by Zielinski et al. (1996) in the southern Sierra. Spencer (1981) indicated that marten use in east side habitats was very closely connected to riparian or more mesic red fir sites in eastside Sierran habitats.

Status

The SNFPA ROD committed to develop a conservation assessment for several forest carnivore species, including this species. A working group of biologists from the Forest Service, National Park Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. Completion of the conservation assessment is expected in fall 2004

Historic and Current Distribution

The FEIS noted that the historic range and distribution of marten included all Sierra Nevada national forests. The current distribution is less well known with scattered detections from systematic surveys and casual observations. Some systematic surveys on the Plumas and Lassen National Forests reported negative detections (Kucera et al. 1995) in areas where marten are believed to exist. Survey methodologies for marten have been improved in recent years, but at this time, insufficient survey effort across the bioregion make it difficult to estimate the current distribution. Although habitat does not appear to have supported a high density of marten in eastside habitats, there have been a limited number of detection in eastside habitats on the Plumas, Lassen and Tahoe National Forests and there are recent detections of marten in eastside habitats on the Inyo and Humboldt Toyiabe National Forests.

Risk Factors

For a summary of risk factors, see the FEIS, volume 3, chapter 3, part 4.4, pages 2-10.

Recreational Activities

The FEIS in volume 3, chapter 3, part 4.4, page 26 addressed generalized wildlife responses to recreation and disclosed that effects of recreation on marten have not been studied. Measurement of glucocorticoid in urine and feces has been used to investigate stress physiology in wild animals (Wasser et al. 1988, 1997; Creel et al. 2001). High glucocorticoid levels are linked to reduced survival and reproduction in captive animals (Munck et al. 1984, Sapolsky 1992). It is assumed that marten may respond similarly, but the effect of recreational activities on population dynamics is not known.

Fuels reduction and prey habitat relationships

Habitat risk factors are discussed in the FEIS in volume 3, chapter 3, part 4.4, page 23. The FEIS addresses the significance of both down, woody material and crown closure as components of marten habitat. Both of these components also play a significant role in providing habitat for marten prey. A reduction in either down, woody material or crown cover can influence the distribution and abundance of marten prey. Bull and Blumton (1999) tested the effects of three different fuels reduction treatments on small mammal populations in lodgepole pine (*Pinus contorta*) and mixed-conifer (subalpine fir dominated) stands in northeastern Oregon. Numbers of red-backed voles and snowshoe hares declined while numbers of chipmunks increased 1-2 years after harvest in lodgepole pine and mixed-conifer stands. They found less of a decline in the number of snowshoe hares, no decline in squirrels, and an increase in red-backed voles after *island treatment* (i.e. where 20% of an area was left unharvested in 1 acre islands) compared to scattered treatments (where 40 logs per acre were scattered throughout the treatment unit).

The lack of decline in red squirrel detections after the island treatment and the mixed conifer harvest suggested that those treatments continued to provide suitable squirrel habitat. The island treatments involved retention of islands of logs that provided subnivean structures essential for squirrel survival in winter. The mixed-conifer treatment involved retention of large diameter trees, which could continue to provide a food source for squirrels. The mixed-conifer stands were apparently no longer suitable habitat for snowshoe hares after treatment. The island treatment, which resulted in less of a decline in hares, probably provided better habitat than the scattered treatment, because the islands contained undisturbed pockets of regeneration as well as logs (Bull and Blumton 1999).

Bull and Blumton (1999) cautioned that the small samples and a short study period limit applicability of their study results to other areas. The general findings that pockets of regeneration and untreated areas, down logs, and legacy large diameter trees provide habitat for small mammals, however, should be broadly applicable to small mammal species in Sierra Nevada habitats.

3.2.2.3. California Spotted Owl (*Strix occidentalis occidentalis*)

This section updates and supplements information found in the FEIS in volume 3, chapter 3, part 4.4, pages 69-112. New information relevant to the SEIS includes a new analysis of California spotted owl population trends, an assessment of fire effects on protected activity centers (PACs) since 1993, southern California drought-related mortality, corrections of PAC numbers, the 12-month finding by the U.S. Fish and Wildlife Service that listing the species was not warranted, and an evaluation of the contribution of private timberland to owl habitat.

Meta-Analysis and Population Trends

Five demographic studies of the California spotted owl have been ongoing for a number of years. One of the primary objectives of these studies is to monitor fluctuations or rate of change (*lambda*) in owl populations. The most appropriate measure of the rate of change of spotted owl populations has been debated considerably, as discussed in the FEIS (volume 3, chapter 3, part 4.4, pages 71-72) and in the review of the SNFPA FEIS (USDA Forest Service, Pacific Southwest Region 2003g). Historically, spotted owl researchers have estimated the rate of change using a *Leslie projection matrix* that is based on estimates of age or stage-specific survival and fecundity (Franklin et al. 1996a). This method was the best available at the time it was used for estimating rates of population change. Nevertheless, a debate on rates of population change using *lambda* has centered on two issues: unknown rates of juvenile emigration from the study areas and potential bias in estimates of juvenile survival (Franklin et al. 2003).

In 2001, the Pacific Southwest Research Station brought together a team of 16 scientists to develop and document results of a meta-analysis[1], using data gathered from five California spotted owl demographic studies, in an effort to assess population status and trends (Franklin et al. 2003). This group used a new approach to estimate changes in owl numbers within the study areas: a recently developed analytical technique to estimate lambda directly from the capture-recapture data (Padel 1996, Nichols and Hines

[1] A meta-analysis is an analytical (mathematical) tool to evaluate population status and trend over time.

2002). Table 3.2.2.3a compares the results of *lambda* utilizing the original projection-matrix and the capture-recapture methods (Franklin et al. 2003).

Table 3.2.2.3a. Comparison of Lambda (λ) from Projection Matrix and Capture-Recapture Methods.

Study Area	Years	Projection Matrix			Capture-Recapture		
		λ	SE	95% CI	λ	SE	95% CI
Eldorado	1986-1998	0.930	-	-	1.042	0.047	0.950-1.133
Lassen	1990-1998	0.923	-	0.888-0.958	0.985	0.026	0.934-1.036
San Bernadino	1986-1998		-	-	0.978	0.025	0.929-1.026
Sierra	1987-1998	0.898	-	-	0.961	0.024	0.915-1.008
Sequoia/Kings	1988-1998	0.940	-	-	0.984	0.047	0.892-1.076

Note: λ is the best estimate of the population rate of change. SE is the standard error of the estimate of λ. 95% CI is the range in the actual value λ for which probability is at least 95%. (Source: Franklin et al. 2003)

As displayed in the table above, λ varies among study areas and analysis methods. It must be noted that in general both methods show a declining trend in populations. The capture-recapture method indicates that the rate of decline may not be as great as originally predicted using the projection-matrix method. However, the capture-recapture methodology is not statistically different than $\lambda = 1$, which would indicate a stable population.

The meta-analysis still identifies a great deal of uncertainty regarding rangewide population trends. The group could not determine whether the results of the meta-analysis were representative of owl demographic trends throughout the Sierra Nevada. For example, if at the inception of these studies, habitat management in the study areas was different than that of the surrounding areas, or changed as a result of study initiation (i.e. study areas were preferentially protected from management activities), then general inference beyond the study areas cannot be made (Franklin et al. 2003).

Information about reproductive success for the last two years is also available. While 2002 appears to have been a good year for California spotted owl reproductive success, 2003 appears to be relatively poor. It is important that reproductive success from individual years cannot be used to indicate overall population trends as it is widely recognized that the species has periodic breeding pulses. The ecological triggers for breeding pulse and non-pulse years are not fully known. Hypotheses relating pulses to spring weather conditions have been suggested by many as summarized in Lee and Irwin 2003. The relationship of nest stand characteristics and weather as it affects reproductive success are untested but it is likely that habitat conditions at the nest site mitigate weather effects (Lee and Irwin, in review).

Fire Effects on PACs

Concerns continue to arise regarding the urgency or necessity of fuels treatment to protect resources, including California spotted owl habitat (FEIS volume 2, chapter 3, part 3.5, pages 238-260). During the management review of the SNFPA, a geographic information system was used to determine the number and acreage of spotted owl PACs that burned in wildfires from 1970 – 2001. This evaluation was updated for the SEIS to only consider fires since the creation of PACs in 1993 and to include the 2002 fire season. Prior to 1993, survey efforts to detect spotted owls were variable across national forests and it is unknown how many owl territories may have shifted over time in response to earlier fires or in response to other forest activities and/or changes in forest vegetation. Therefore, it is not possible to isolate fire effects on PACs established prior to 1993.

The evaluation for the SEIS was done by overlaying wildfire perimeters (1993-2002, greater than 10 acres) with PAC boundaries as they were mapped in the regional geographic information system data library in 1997. This data is used as a proxy to represent the original PAC boundaries. It is known that some PACs have been adjusted following wildfires or other events that occurred between 1992 and 1997 and many PACs were mapped at larger than the required 300 acres. This is in contrast to the revised mapping done for other analyses in the SEIS where PAC boundaries have been refined by the individual national forests and adjusted to incorporate the best available current information on vegetation conditions and owl locations and adjusting for past disturbances, such as recent wildfires.

This updated analysis identified 104 PACs that have had a wildfire burn within their boundary, affecting 40,200 acres within the PACs. From 1993 to 2003, approximately 7% of the 1,422 PACs and 7% of the 616,111 acres of PACs have been burned. Again, note that the number of PACs and PAC acreage for this analysis is different than the current number of PACs analyzed in the remainder of this SEIS. Only PACs on NFS lands were included in this analysis. The resulting change in vegetation composition and structure related to owl habitat that has resulted from these wildfires has not been estimated. Estimates of fire effects are typically limited to burn intensity, to help evaluate the risk of soil erosion and need for emergency rehabilitation of burned areas. These evaluations do not focus on the extent of stand structure changes (tree mortality) or retention of living trees, which are necessary parameters for evaluating habitat suitability for spotted owls. Habitat effects from wildfires cannot be fully measured immediately following wildfire, because direct and indirect tree mortality may not become evident for several years. It is unknown, therefore, how much burning of PACs resulted in sufficient loss of live mature trees and changed stand structure to eliminate or significantly diminish habitat suitability for spotted owls.

A number of large wildfires have occurred over the past four years where the immediate effects to habitat within known spotted owl PACs have been documented. They include the Buck Incident (1999) on the Plumas National Forest, Storrie Incident (2000) on the Lassen and Plumas National Forests, the Manter Incident (2001) and McNally Incident (2002) on the Sequoia National Forest, the Star Incident (2001) on the Eldorado and Tahoe National Forests, and the Gap Incident (2001) on the Tahoe National Forest. Each of these fires influenced one or more PACs, the magnitude of which will not be fully understood for many years. However, most of these fires did lead to total or partial loss of PACs, as determined by the extent of mortality of mature conifers immediately following the fire. Over this same period of time, 47 PACs experienced wildfire within their boundaries across the bioregion. This recent history suggests that the rate of damage to PACs by wildfire is increasing. Table 3.2.2.3b identifies those PACs that have burned sufficiently for the original PACs to be considered lost.

Table 3.2.2.3b. PACs Significantly Diminished by Wildfire, 1999-2002.

National Forest	Incident	PAC ID	PAC acreage	Acreage changed to non-suitable habitat
Plumas	Bucks	PL264*	284	284
	Bucks	PL188*	323	200
	Storrie	N1*	344	264
	Storrie	PL098*	302	280
	Pendola	YU016	358	30
	Stream	PL073*	414	352
	Stream	PL106*	404	391
	Stream	PL126*	520	456
Tahoe	Pandola	YU001*	303	200
	Star	PC026*	318	266
	Star	PC027	322	98
	Star	PC028*	342	108
	Star	PC034*	307	128
	Star	PC072	362	1
	Star	PCO78	308	54
Eldorado	Star	PC055*	300	289
	Star	PC075*	300	272
Sequoia	Manter	TU060*	277	235
	McNally	TU112*	364	352
	McNally	TU053*	325	290
	McNally	TU054*	300	238
	McNally	TU176*	354	354
	McNally	TU178	368	323
	Highway	FR144	301	300

*Note: * indicates those PACs considered to be lost due to fire effects. (Source: USDA Forest Service 2003d)*

Of the total PACs affected by these recent wildfires, eighteen could be considered lost due to the amount of habitat that has been rendered unsuitable. For this analysis, it is not fully known to what extent individual owls from these affected PACs have been able to find suitable replacement habitat nearby. In at least two cases (PC055 and PC075 on the Eldorado National Forest), while the original PAC was rendered unsuitable, the owls were part of a demographic study and were individually marked and were found to have moved into unburned areas outside of the fire area. In other cases, there are no unburned areas within a typical home range distance (1.5 miles). This suggests that these individual owl territories could not be occupied until habitat conditions return to the area, which would likely take many decades. Since these owl territories cannot be occupied until sufficient habitat develops, they will be removed from the Forest Service's designated PAC network following the guidelines that apply to both alternatives.

The geographic pattern of large wildfires appears to account for some visible gaps in owl distribution (e.g. Stanislaus National Forest in the area of the 1987 wildfires). Most of these areas were not surveyed for owls prior to the fires so the number of affected owls is unknown, however, there are no existing PACs in these areas, primarily due to the lack of large areas of suitable habitat following the fires.

An annual average of 4.5 PACs have been lost or severely modified by wildfire since 1998. This equates to an annual loss of approximately 0.34% per year. Given that owl PACs are fairly evenly distributed within approximately the western two-thirds of the Sierra Nevada national forests, it appears that the rate of loss of PACs is proportional to the extent of large wildfires within this zone. If the hypothesized trend of increasing large high severity wildfires across the Sierra Nevada is correct, the rate of loss of PACs would be expected to mirror this increase.

Southern California Drought-Related Mortality

Southern California forests in San Bernardino, Riverside, and San Diego Counties, although outside the planning area of this SEIS, are experiencing the worst drought in more than 450 years (Loe, personal communication 2003). As a result, the risk of loss of spotted owl populations in these areas may be significant. The big cone Douglas fir and the mixed conifer types are stressed by drought and combined with overstocked conditions, pollution, mistletoe, root disease, and bark beetle infestations, are experiencing mortalities of more than 40% in some areas (Loe, personal communication 2003). As larger, older trees and the associated canopy layers are lost due to mortality, degradation of spotted owl nesting and prey habitat will occur.

The high level of mortality being experienced in this area lies in the center of the spotted owl population in Southern California. The San Jacinto Mountains are experiencing especially high mortality; in October of 2002, an estimated 66,000 acres, including all vegetation types, were affected. The total acreage affected to date is more than 354,000 acres. An estimated 175,000 acres of pine and mixed conifer were considered affected by April 2003; much of this acreage is considered spotted owl habitat. The San Bernardino National Forest is removing the hazardous fuels as rapidly as possible, to reduce impacts of future wildfires on the remaining forest vegetation. Seventy known PACs are presently being monitored to determine the effects of the drought and subsequent fuels treatments (Loe, personal communication 2003).

Wildfires in 2002 and 2003 have had substantial impacts to the southern California populations of the California spotted owl. Large fires in those years burned within many territories but resulted in serious effects to approximately 29 territories: 9 in the San Gabriel Mountains; 14 in the San Bernardino Mountains; 5 in the San Diego Mountains; and 1 in the Southern Los Padres Ranges (Loe, personal communication 2003). The effects of these wildfires on owl populations is not fully known at this time.

Although this drought mortality is not within the Sierra Nevada bioregion, it provides a warning of the potential for widespread mortality within the Sierra Nevada bioregion where similar high-density forest stand conditions exist. Under existing conditions, if cyclic drought conditions occur in the Sierra Nevada, the potential losses to habitat could make conservation of the species difficult by creating large gaps in distribution.

Corrections to PAC numbers

The FEIS analyzed 1,310 PACs (FEIS volume 3, chapter 3, part 4.4, page 84). Subsequent to the SNFPA ROD, the Sierra Nevada national forests were directed to evaluate spotted owl-sighting data and apply the criteria for establishing PACs that was outlined in the ROD (page A-33). For this SEIS, updated maps for PACs from several forests (Lassen, Plumas, Eldorado, Tahoe, and Toiyabe) were used, resulting in 1,321 PACs included in the current analysis. As a result of this improved mapping, the acreage in PACs has changed from approximately 613,138 acres in the FEIS to an estimated 421,780 acres in the current analysis. Although the number of PACs has increased, the total area in PACs has decreased, because many PACs that were larger than the prescribed 300 acres were re-mapped to a smaller size by the individual national forests. The current average size of PACs is 320 acres, although the largest PAC is 1,119 acres. The number of PACs across the bioregion can change over time as new territories are discovered and as habitat is rendered unsuitable due to wildfire or other causes and are removed from the network per the direction contained in the alternatives.

The FEIS makes little specific reference to the number of home range core areas (HRCAs). There should be a one-to-one correlation between PACs and HRCAs. Included in this analysis are 1,320 HRCAs, possibly indicating some remaining errors in mapping; however, differences in the number of HRCAs compared to PACs may be due to HRCAs for which corresponding PACs are located on private lands. Describing the average HRCA size is not meaningful, because sizes are variable across the bioregion and some are smaller than the required acreage due to land ownership patterns.

U.S. Fish and Wildlife Service (FWS) 12-Month Findings for a Petition to List the California Spotted Owl

In April 2000, the FWS received a petition filed by the Center for Biological Diversity and the Sierra Nevada Protection Campaign for the listing of the California spotted owl as a threatened species. These groups subsequently challenged the FWS to issue a finding on the petition, resulting in a federal court order to finish the determination by February 10, 2003. Completing a 12-month review as required by the Endangered Species Act, FWS biologists concluded, based on the best scientific and commercial information available, that the overall magnitude of current threats to the California spotted owl does not rise to a level requiring federal protection (68 FR 7589-7608).

The finding acknowledged that the SNFPA ROD and its associated *California Spotted Owl Conservation Strategy* established the current management direction being implemented on National Forest lands across the Sierra Nevada and considered the ramifications of this management in making its finding. The finding recognized two efforts that could affect this determination: 1) a management review of the SNFPA (leading to this SEIS); and 2) planning for implementation of an administrative study on the Lassen and Plumas National Forests. FWS stated that it would monitor the development of management direction that could affect the California spotted owl, offer scientific assistance to the Forest Service and other responsible agencies, and review the effects of the current management direction at a later date, if necessary.

Contributions of Private Timberland to Habitat

The management review of the SNFPA (USDA Forest Service, Pacific Southwest Region 2003g) identified potential contributions of private timberlands to California spotted owl habitat across the bioregion, primarily based upon the California Forest Practices Act and a ten-year sustained yield plan for Sierra Pacific Industries. Controversy exists about relying on habitat on private timberlands to maintain spotted owl viability, due to varying management objectives of private timberland owners and the lack of regulatory direction for them to manage their timberlands specifically to ensure owl viability. Without comprehensive planning for the species between federal and state agencies and private landowners, the persistence of habitat in an appropriate temporal and spatial arrangement that will provide for continued use by the species is not assured.

A recent report (Irwin et al. 2003) describes studies of both California and northern spotted owls, primarily on private timberlands, and suggests that management of private timberlands may be compatible with maintaining suitable owl habitat. Because this report has not received widespread distribution and has not been peer-reviewed, its applicability to management of spotted owls on National Forest System lands cannot be fully evaluated. This SEIS acknowledges that habitat currently exists on portions of private timberlands adjacent to National Forest System lands and is undoubtedly used by spotted owls today. Since the long-term distribution and suitability of habitat on private timberlands is unknown, the presence of this privately held habitat was not assumed to mitigate effects of vegetation management on National Forest System lands. Further review and research on spotted owl habitat requirements, and on the relationship of owl productivity with forest management, is expected to eventually allow assessment of the cumulative effects of vegetation management within habitat that crosses public and private land ownerships.

3.2.2.4. Northern Goshawk (*Accipiter gentilis*)

There was no new information since the publication of the FEIS that is relevant to assessing the effects of the alternatives on this species. The information in the FEIS, volume 3, chapter 3, part 4.4, pages 113-124, including the information on habitat requirements and risk factors, was used for the assessment of effects.

3.2.2.5. Willow Flycatcher (*Empidonax trailii adastus,* and *E. t. brewsterii*)

This section updates and supplements the information found in FEIS volume 3, chapter 3, part 4.4, pages 143-161. A Conservation Assessment (Green et al. 2003) was prepared for this species as directed by the SNFPA ROD. That document includes a detailed description of species life history and risk factors considered in this analysis. Only those portions most relevant to analysis in the SEIS are summarized in this section. Information about the southwestern willow flycatcher (*E.t. extimus*) is found in the FEIS, the biological assessment for this SEIS (USDA Forest Service Pacific Southwest Region 2003a), and in Appendix C of the SEIS.

Life History

Breeding

Estimating willow flycatcher fledging dates cannot be done with certainty because willow flycatcher arrival dates, snowpack, summer weather, nest predation, and brown-headed cowbird brood parasitism influence the length of the nesting season. Weather, predation, and brood parasitism can result in multiple re-nesting attempts. As many as three nesting attempts in one breeding season have been documented for willow flycatcher territories in the Sierra Nevada (Morrison et al. 1999).

A recent compilation of multiple years of Sierra-wide willow flycatcher nesting data reveals that willow flycatchers fledge young between approximately July 15 and August 31 and fledglings remain in territories for 2 to 3 weeks post-fledging (158 nests; Stafford and Valentine 1985, Sanders and Flett 1989). Prior to the compilation of these nesting data, and based on an earlier recommendation by Valentine (1987), Valentine et al. (1988), and Harris et al. (1987, 1988), the willow flycatcher nesting period for some Sierra Nevada meadows was assumed to extend through August 15. The more recent analysis incorporates all available willow flycatcher nesting data for the Sierra Nevada and indicates that the Sierra Nevada willow flycatcher nesting period extends from June 1 to August 31. Approximately 10% of the total successful nesting attempts occur between August 15 and August 30. Although there is some speculation that late-fledging individuals (after July 15) may have a lower survival rate than early-fledging individuals (Sedgwick and Iko 1999), this parameter has not been specifically evaluated for the Sierra Nevada.

Brood Parasitism

The impact of brown-headed cowbirds on willow flycatchers varies within the Sierra Nevada bioregion. Long term research shows that brown-headed cowbirds impact willow flycatcher populations (in particular, the southwestern willow flycatcher subspecies) outside the planning area (Sedgwick and Iko 1999, Whitfield 1990, Whitfield and Enos 1996, Whitfield and Sogge 1999). Although brown-headed cowbirds impacted less than 7% of observed willow flycatcher nests in the Sierra Nevada between 1997-2000, their influence could become greater if willow flycatcher populations decrease, brown-headed cowbird populations increase, or both occur (Whitfield and Sogge 1999, Morrison et al. 2000). Because mountain communities are expanding in many areas, and brown-headed cowbirds are highly associated with human activities, brown-headed cowbirds may increase in at least some portions of the bioregion (Verner and Ritter 1983).

In the Lake Tahoe Basin in 1998 through 2000, high cowbird abundance resulted in parasitism of 8 of 18 nests (44%) (Morrison et al. 2000). Smith (1999 in Stefani et al. 2001), in a review of recent cowbird studies, suggests that management actions to control cowbirds may not be warranted unless the parasitism rate is at least 60%. However, he lists criteria that might suggest desirability of control efforts where parasitism rates are lower, including restricted habitat, isolated populations, and populations in prolonged decline. This recommendation suggests that the few remaining breeding locations within the Tahoe Basin may benefit from cowbird management, if the current parasitism rate remains consistent or increases (Whitfield and Sogge 1999, Whitfield et al. 1999). Nonetheless, high density of brown-headed cowbirds and high private land ownership in the area could make control difficult and limit its effectiveness (Citta and Mills 1999 in Stefani et a. 2001, Hall and Rothstein 1999, and Whitfield and Sogge 1999). It has been suggested that brown-headed cowbird trapping programs and removal or relocation of livestock facilities to reduce cowbird abundance should be evaluated based on risk levels and likely effectiveness (Verner and Rothstein 1988, Whitfield and Sogge 1999, Whitfield et al. 1999).

In the 13 documented cases of brown-headed cowbird brood parasitism of willow flycatcher nests in the central Sierra Nevada for which dates are known, parasitism events occurred from approximately June 17 to August 4 (the mean was July 4 and the standard deviation was 12 days) (Sanders and Flett 1989). These parasitism dates correspond to willow flycatcher's initiation dates for egg incubation of June 15 to August 1 (Stafford and Valentine 1985, Sanders and Flett 1989). Cowbird egg-laying dates and willow flycatcher incubation-initiation dates are likely to vary across the bioregion, and the amount of overlap between incubation dates for the two species would influence the risk of parasitism. In the Dinkey Creek area of the Sierra National Forest, Verner and Ritter (1983) found that cowbirds rarely arrive at pack stations prior to the pack animals. Thus, delaying use of pack stock facilities beyond estimated dates of brood parasitism may be a means to eliminate or alleviate this threat in some areas of the Sierra Nevada, although this theory has not been tested.

Bombay and Morrison (2003) reported an increase in cowbird parasitism in the central Sierra Nevada in 2000 (six events) and 2001 (five events) over previous years. The reason for this increase is not completely known; however, it could be partially due to the slightly earlier onset of willow flycatchers nesting during those two years. This shift would have resulted in a greater overlap in the two species' breeding periods (Verner and Rothstein 1988).

Status

Although the willow flycatcher population in the Sierra Nevada declined substantially after 1940, the current direction and magnitude of the demographic trend are uncertain (Serena 1982, Stafford and Valentine 1985, Flett and Sanders 1987, Harris et al. 1987 and 1988, Valentine et al. 1988, and Sanders and Flett 1989). However, if preliminary nesting site re-occupancy data and central Sierra Nevada nest success and fecundity rates are used as measures of population trend, the willow flycatcher population in the Sierra Nevada appears to have continued to decline during the past two decades (Morrison et al. 2000). Both subspecies are Forest Service sensitive species in Region 5.

Historical and Current Distribution – Recent Surveys

Although distribution, abundance, and demographic data for willow flycatchers in the Sierra Nevada bioregion have significant uncertainty, monitoring of willow flycatcher populations and habitat conditions on national forests in the planning area has increased significantly since the SNFPA ROD was adopted in 2001. As a result of the survey requirements of the ROD, the national forests have worked diligently to complete the necessary surveys. The Forest Service conducted two-day training workshops in 2001 and 2002 for biologists and technicians charged with conducting these surveys. Over 50 employees were trained. The survey workshops will be held annually to train new employees and refresh the skills of previously trained employees conducting the surveys.

For the FEIS, a sighting database was developed that identified 135 locations where willow flycatchers were known to occur. Since that time the sighting database has been reviewed and the database is currently in the final stages of being validated (review expected to be completed in December 2003, Stefani, personal communication 2003). Four sites on the Sequoia National Forest and one site on the Inyo National Forest are believed to be of the southwestern willow flycatcher subspecies and those records are being removed from the database count, bringing the baseline number of sites in the database to 130. Based upon the preliminary review, six additional sites (five on national forest lands, one on private land) are being considered for removal from the list of known willow flycatcher sites as displayed in Table 3.2.2.5a. Assuming that the six additional sites are removed from the final database, the current number of known willow flycatcher sites under the SNFPA ROD is 124 sites (See Appendix D).

Table 3.2.2.5a. Re-assessment of known willow flycatcher sites identified in the FEIS.

Site	Forest	Status
Manter Meadow	Sequoia NF	Southwestern willow flycatcher – SITE EXCLUDED, on NFS land
Rodeo Flat	Sequoia NF	Southwestern willow flycatcher – SITE EXCLUDED, on NFS land
South Fork Kern	Sequoia NF	Southwestern willow flycatcher – SITE EXCLUDED, on private land
Bloomfield Ranch	Sequoia NF	Southwestern willow flycatcher – SITE EXCLUDED, on private land
Owens River	Inyo NF	Southwestern willow flycatcher – SITE EXCLUDED, on private land
Summit Meadow	Sequoia NF	Poor habitat - Possibly on private land – proposed to drop site from db
Silver Creek	Tahoe NF	No suitable habitat – proposed to drop site from db
Squaw Creek	Tahoe NF	No suitable habitat – proposed to drop site from db
Bearcamp 1	Modoc NF	Sighting veracity questioned – proposed to drop site from db
Bearcamp 2	Modoc NF	Sighting veracity questioned – proposed to drop site from db
Mammoth Creek	Inyo NF	Private land, site conversion – proposed to drop site from db

(Source: USDA Forest Service Pacific Southwest Region 2003c)

A preliminary geographic information system analysis has occurred of the known willow flycatcher sites in the database. Of the 124 known sites, 49 appear to be within active cattle allotments, 9 appear to be within active sheep allotments, 5 appear to be within inactive cattle allotments, and 61 appear to be outside of allotment boundaries as shown in Table 3.2.2.5b.

Table 3.2.2.5b. Grazing Allotment Status of 124 known willow flycatcher sites.

	Active Cattle	Active Sheep	Inactive	Outside Allotment	Total
Eldorado	1	0	0	0	1
Inyo	1	2	1	9	13
Lake Tahoe Basin	0	0	0	7	7
Lassen	10	0	2	7	19
Modoc	3	1	0	1	5
Plumas	4	0	0	14	18
Sequoia	5	0	0	0	5
Sierra	11	0	0	2	13
Stanislaus	7	0	0	1	8
Tahoe	5	6	0	5	16
Toiyabe	2	0	2	3	7
Non-NF	0	0	0	12	12
Total	**49**	**9**	**5**	**61**	**124**

(Source: USDA Forest Service Pacific Southwest Region 2003e)

For the 61 sites outside of allotment boundaries, the distance to the nearest allotment was calculated and grouped by allotment status as shown in Table 3.2.2.5c.

Table 3.2.2.5c. Nearest Distance to Grazing Allotment by Status for 61 known willow flycatcher sites where the site location is not within an allotment.

	Active Cattle	Active Sheep	Active Horse	Inactive	Total
Less than 1 mile	16	8	1	3	28
1 to 5 miles	16	5	0	6	27
More than 5 miles	3	0	0	3	6
Total	**35**	**13**	**1**	**12**	**61**

(Source: USDA Forest Service Pacific Southwest Region 2003e)

Due to known mapping inaccuracies, mapped territory points do not always designate the location of existing nests, as not all sites have been updated using modern global positioning system technology and individual territories at a site have not been mapped. As a result, land ownership associated with some known sites and territories may not be accurate. The preliminary geographic information system analysis (Appendix D) validates that 74 sites have the mapped territory point on National Forest System land. This correlates with the FEIS estimated 82 sites minus 1 site (Sulphur Creek on the Sierra National Forest) that was incorrectly mapped, minus the 2 southwestern willow flycatcher sites, and minus the 5 sites proposed for removal by the forests. The analysis also indicates that 17 additional sites have mapped territory points outside of NFS lands but are associated with meadows that extend onto the national forests. Of these, all but one are in close proximity (less than 3 miles distant) to an active allotment. There are an additional 33 sites that occur on private land within or adjacent to the national forest boundary where the underlying meadow system is entirely on private lands. Of these, three are within an allotment boundary and three are not associated with an allotment. Most of the remaining 27 sites are located within five miles of an allotment. These sites will require site-specific evaluation to determine if activities on NFS lands could affect the territories and if they should be considered in the pool of known sites for evaluating effects.

Surveys conducted in 2001 and 2002 covered all known willow flycatcher sites according to established survey protocols. As of January 2003, approximately half of the National Forests in the SNFPA planning area reported that all of the emphasis habitat meadows for willow flycatcher on their forest had been identified and mapped, while the other forests reported that this process was well under way (Stefani 2003). Protocol surveys of these areas have been completed for 133 meadows of the 496 potential emphasis habitat meadows identified according to direction in the ROD. These surveys have revealed the presence of 11 previously unknown territories. These territories have not yet been entered into the current willow flycatcher database and are not reflected in the analysis for the SEIS. They will be managed according to the site occupancy classification under each alternative. The remaining areas are currently being evaluated to determine if suitable habitat exists that would warrant protocol surveys (Stefani 2003). The use of a five-mile distance for delineating emphasis habitat was to capture the 90^{th} percentile distance that fledglings traveled during dispersal. There is some indication that dispersal distances may vary across the Sierra Nevada bioregion, with some fledglings dispersing over distances of up to 12 miles (Green et al. 2003).

Recent data available from the demographic and monitoring study in the north-central Sierra Nevada is not encouraging with regard to willow flycatcher population trends. The total number of territories at 15 monitoring sites declined from 62 in 1998 to 45 in 2001, and to only 37 territories in 2002 (Bombay and Morrison 2003). Perrazo Meadows on the Tahoe National Forest has been consistently surveyed since 1997. The number of territories there has declined from a high of 12 in 1997 to a current low of only 2 (in 2002) (Bombay and Morrison 2003). Consistent survey efforts on the Sierra and Stanislaus National Forests in the past several years show a lack of willow flycatchers at a number of well-known breeding areas in the central and southern Sierra Nevada. In addition, three years of surveys on the Sequoia National Forest have failed to re-confirm earlier occupancy by willow flycatchers.

Risk Factors

For a summary of risk factors, see the FEIS, volume 3, chapter 3, part 4.4, pages 152-162. The Conservation Assessment (Green et al. 2003) discusses all of those risk factors and identifies additional risks of water development and pesticide drift from the Central Valley and pesticide use in Central and South American wintering grounds.

3.2.2.6. Great Gray Owl (*Strix nebulosa*)

For describing the affected environment and conducting effects analysis in the FEIS, the great gray owl was grouped with eight other diurnal and nocturnal raptors. More specific information about this species is presented to supplement the information found in FEIS volume 3, chapter 3, part 4.2, pages 40-42.

Life History

General biological information specific to the great gray owl in the Sierra Nevada can be found in *Survey Protocol for the Great Gray Owl in the Sierra Nevada of California* (Beck and Winter 2000). Key information from that document is summarized in the following sections.

Breeding

The breeding density of the great gray owl seems limited by both prey and nest site availability. In general, it favors abandoned nests of other birds of prey, but in California it prefers the tops of broken trees or nest cavities in trees near montane meadows. In other parts of its range, it has nested on artificial platforms. Although well studied in Scandinavia, less is known about this species in North America, and the limited research specific to the Sierra Nevada is focused on the Yosemite National Park-Stanislaus National Forest area.

Timing of breeding activities varies along both a north-south gradient and an elevation gradient in California. Egg laying in California begins in late March or early April at low elevation sites, and can be as much as a month later at high elevation sites. Courtship activities occur a month prior to egg laying. Snow conditions on the breeding grounds appear to control the onset of nesting, and it is possible that late spring rains cause nest abandonment.

This species' incubation period is about 30 days, and a typical clutch size is 2-3 eggs, although usually only 1-2 chicks survive the 26-28 days required to fledging (Beck and Winter 2000, Bull and Duncan 1993). After leaving the nest, young owls readily climb leaning trees and roost off the ground. They are capable of flight 7-14 days after leaving the nest (Franklin 1988). Females stay near the fledged young to protect them and the male continues to bring prey. In Oregon, after 2-6 weeks, females abandon the young; however, males continue to provide care by feeding the young for up to 3 months (Bull and Henjum 1990). Juveniles start hunting on their own at an age of about 3 months. The young are independent by late summer and disperse in fall and winter. Maximum distances that radio-tagged juveniles disperse from natal sites in their first year ranged from 4.6 to 29 miles in an Oregon study (Bull et al. 1988) and up to 468 miles in a Canadian study (Duncan 1992). Most juveniles remain near the natal site. The relationship of juvenile dispersal behavior of Sierra Nevada populations and populations in these studies is unknown.

Individuals can be long lived. In Oregon, the probability of a juvenile surviving its first year is 0.53 and its first two years is 0.31 (Bull et al. 1989). Oeming (1964) reports the existence of a 9-year-old bird in the wild. A female banded as an adult was recaptured 13 years later.

In general, great gray owls tend to be monogamous. In boreal forest regions, the pair bond is not maintained over the winter. However, individuals may nest with the same mate in subsequent years if prey populations remain high (Duncan 1992). In Oregon, Idaho, and California, pairs probably remain together as long as both live, but either sex will re-mate if its first mate disappears.

Diet

The diet of the great gray owl may vary locally but consists primarily of small mammals, predominantly rodents. All available literature indicates that great gray owls in the western United States overwhelmingly select only two prey taxa: voles (*Microtus* spp.) and pocket gophers (*Thomomys* spp.). Voles prefer meadows with dense herbaceous vegetative cover (Zeiner et al. 1990b). A four-inch stubble height at the end of the growing season is thought to provide suitable cover for voles (Beck 1985), although other studies suggest herbaceous heights of 12” are preferred (Greene 1995). Gophers are predominantly subterranean but they also appear to have herbaceous cover preferences (Greene 1995). Great gray owls catch these mammals by breaking through their tunnels. Compaction of meadow soils may reduce the suitability of areas for gophers. During the winter, great gray owls have been observed plunging through the snow to capture prey.

Mortality

Collision with motor vehicles a major source of mortality in some areas. Shooting is still common in many areas (Nero and Copeland 1981). However, these types of mortality have not been identified as significantly threatening the species in the Sierra Nevada (Beck and Winter 2000). Predation of eggs and young by other raptor species, especially great horned owls, may be common. Impalement on barbed wire and electrocution on transmission lines have been reported.

Habitat relationships

Summer

The elevation ranges of great gray owl habitat in California varies from north to south, with higher elevation ranges in the southern Sierra than in the northern Sierra (see table 3.2.2.5a).

Table 3.2.2.5a. Elevation Zones of Great Gray Owl Habitat in the Sierra Nevada.

Region	Low Elevation	Middle Elevation	High Elevation
Northern Sierra Nevada	2,000 to 3,000 feet	3,000 to 5,000 feet	Above 5,000 feet
Central Sierra Nevada	2,500 to 4,000 feet	4,000 to 6,000 feet	Above 6,000 feet
Southern Sierra Nevada	3,500 to 5,000 feet	5,000 to 7,000 feet	Above 7,000 feet

(source: Beck and Winter 2000)

The seasonal timing of nesting is different in each of these elevation zones, which are used primarily to define survey timing. The Lassen, Plumas, and Tahoe National Forests are considered to be in the Northern Sierra Nevada, the Central Sierra Nevada includes the Eldorado and Stanislaus National Forests, and the Southern Sierra Nevada includes the Sierra and Sequoia National Forests. Elevation zones are not described for the Modoc, Inyo, and Humboldt-Toiyabe National Forests; the Lake Tahoe Basin Management Unit; and the eastside of the Lassen, Plumas, and Tahoe National Forests.

This species typically forages in meadows and other open, early-stage habitats supporting small mammals. It nests and roosts in nearby dense (greater than 40% canopy closure) coniferous forest at elevations between 2,500 and 8,000 feet. Nest sites in Yosemite National Park and on the Stanislaus National Forest are in large trees (greater than 30” dbh) in stands that have canopy cover greater than 70% (Greene 1995). Forest age does not seem to matter, provided suitable nest sites are available. Nest sites have been documented in conifer and black oak snags with broken tops, abandoned hawk nests, and artificial nest structures. In California, nests are generally located within 840 feet of the forest edge, averaging 500 feet (Winter 2000, Beck and Winter 2000). The CWHR classes which correspond to suitable breeding and roosting habitat are *4M*, *4D*, *5M*, *5D*, and *6*, as defined in Appendix B (page B-3) in the SNFPA ROD. Perennial grasses and sedges provide the dominant forage area cover in meadows (Hayward 1994, USDA Forest Service 2001b). Nests that are persistently occupied in the Yosemite area are generally associated with meadows greater than 25 acres in size (Winter 1986) but smaller meadows (as small as 10 acres) have supported infrequent nesting (USDA Forest Service 2000). Only a portion (13-20%) of great gray owl territories appears to support breeding in a given year (Winter 1999). This species has high fidelity to nest sites, which are often reused for several years (Bull et al. 1988, Franklin 1988, Duncan 1992).

Foraging habitat in the Sierra Nevada is generally open meadows and grasslands in forested areas, and trees along the forest edge are used for hunting perches. Openings caused by fires or timber harvest serves as foraging habitat when the vegetation is in early successional stages (Hayward 1994, Greene 1995). Greene (1995) found that sites occupied by great gray owls had greater plant cover, vegetation height, and soil moisture than sites not occupied by owls. Canopy closure was the only variable of three variables measured (canopy closure, number of snags greater than 24” dbh, and number of snags less than 24” dbh) that was significantly larger in occupied sites than in unoccupied sites.

Winter

In some winters, when its prey is scarce, individuals from northern populations wander south to the northern U.S. and southern Canada, often in considerable numbers. These winter migrations are not believed to extend to the Sierra Nevada. In the Sierra Nevada, the winter range is generally the same as the breeding habitat, except individuals in Yosemite National Park are known to move to lower elevations with thinner snow cover (Winter 2000). Habitat conditions are thought to be similar to those of summer habitat.

Status

The great gray owl is a Forest Service sensitive species in both Region 4 and Region 5. It is known or suspected to occur on the Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, Tahoe, and Humboldt-Toiyabe National Forests, and on the Lake Tahoe Basin Management Unit. It was classified as an endangered species by the State of California in October 1980.

Throughout the species range, density differs greatly from area to area. These differences are probably influenced by food supply and/or nest site availability. The highest nesting density in Oregon was 0.29 pairs/square mile (mi^2) 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).

Historical and Current Distribution

The great gray owl is a holarctic species. It remains evenly distributed across its range but has variability in local distribution. Godfrey (1986) gives it range as 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. 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. The southern populations in the western U.S. are considered relatively stable, breeding every year and remaining in the same general area throughout the year, although, as previously stated, breeding in Yosemite National Park is somewhat sporadic (Winter 1999). The northern populations and those at the southern edge of the range in eastern Canada are considered less stable. The Sierra Nevada populations are the most southerly populations of this species in the world.

No data is available to compare this species’ historical range to its current range.

Risk factors

A number of factors influencing population levels have been identified. Overall, food supply is likely the critical factor regulating populations, especially in scarce-prey years when many individuals may fail to breed.

Population factors specific to California identified in Beck and Winter (2000) include:

- Occupied habitat has apparently declined over the last 100 years.
- The species is dependent on dense forests in mid to late seral stage with large snags and adjacent meadows.
- These habitats have been reduced in many areas due to forest and range management. Both green tree and salvage timber harvest can eliminate potential nest trees. Grazing can remove cover necessary for prey species and degrade meadows, thereby lowering water tables and reducing productivity of grasses and forbs that are food sources for prey. In addition, prescribed burning can remove potential nest snags and downed woody material that provides small mammal habitat.

While strychnine poisoning of pocket gophers typically is not done in meadow environments, poisoning may reduce owl prey in open canopied areas near meadows that are adjacent to suitable nesting habitat. In addition, consuming poisoned prey may poison owls, but such risk is likely low.

3.2.2.7. Foothill Yellow-Legged Frog (*Rana boylii*)

The *habitat requirements* section for this species was inadvertently left out of the FEIS. This section updates and supplements the information found in FEIS volume 3, chapter 3, part 4.4, pages 207-208.

Habitat Requirements

The foothill yellow-legged frog has been found primarily in shallow channels with riffles and at least cobble-sized substrates (Hayes and Jennings 1988). Streams and rivers used by this species have either permanent or intermittent flow, low or high gradient, and alluvial or bedrock channels. The species is also occasionally found in other habitats including moderately vegetated backwaters, isolated pools (Hayes and Jennings 1988), and slow-moving rivers having mud substrates (Fitch 1938).

The ability to withstand and recover from environmental flux is crucial for the survival of any organism living in the highly variable environment of a river. The wet winters and dry summers typical of the Mediterranean climate in the Sierra Nevada have shaped the life-history strategy of the foothill yellow-legged frog. To protect its most vulnerable life stages (eggs and larvae), breeding is timed to take place late enough in spring to avoid extreme high flows. Breeding, however, must occur early enough to allow tadpoles sufficient time to metamorphose, and juveniles time to grow, before the onset of the next wet season. Breeding sites are not continuously distributed along the streams and rivers occupied by this species, because the frogs select channels having particular morphological traits. Species breeding is noted at depositional areas, cobbles, and boulders at tails/outlets of pools. Breeding behavior appears to be influenced by air and water temperature.

The scientific literature indicates that breeding occurs from late March through May, and egg deposition for any single population is concentrated into a two-week period (Storer 1925, Zweifel 1955). More recent reports indicate that breeding activity can be spread over several weeks in the Coast Ranges and up to 31 days in the Sierra Nevada (Van Wagner 1996). Duration of the breeding season appears to be determined by weather. In cold, rainy springs the breeding season is longer than in dry, warm springs.

Egg masses usually contain about 900 eggs, but the number of eggs can range from 100 to over 1,000 per mass (Storer 1925). Eggs must remain inundated and attached to substrates, despite falling/rising water levels. Sustained high-flows subsequent to egg mass deposition may dislodge masses or wash tadpoles downstream. Declining water levels may expose egg masses or leave tadpoles vulnerable to desiccation. In wide, shallow channels, stage and near bank velocity are less sensitive to changes in discharge than they are in deeper, more confined channels. Breeding sites that produce greater than average hatching success have significantly greater width-to-depth ratios than sites where hatching success is low as well as stable channels; low bed mobility; and a coarse surface texture. Other key habitat elements identified are >20% and <90% stream shading (Hayes and Jennings 1988); lack of riparian vegetation encroachment; and lack of introduced predators or competitors (Kupferberg 1997).

In the Coast Ranges, adults congregate at breeding sites in April, May, and June. Later in the summer, adults are scarcely observed along the main stems of larger rivers (the Trinity and Eel Rivers). This absence may indicate movement into the vegetation, movement into tributaries, or simply reduced diurnal activity.

Status

The SNFPA ROD includes a commitment to develop a conservation assessment for several aquatic and riparian species, including this species. A working group of biologists from the Forest Service, National Park Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. The conservation assessment is still in preparation and is unavailable for incorporation into this analysis.

The foothill yellow-legged frog is listed as a Region 5 sensitive species. In addition, the frog is a *species of special concern* in California. Jennings and Hayes (1994) recommended that California state officials adopt *endangered* status in southern and central California south of the Salinas River, Monterey County, and *threatened* status in the “west slope drainages of the Sierra Nevada and southern Cascade Mountains east of the Sacramento-San Joaquin River axis.” In the Coast Ranges north of the Salinas River, the foothill yellow-legged frog still occurs in significant numbers in some coastal drainages but is also at risk due to anthropogenic and environmental threats.

Risk Factors

For a summary of risk factors, see the FEIS, volume 3, chapter 3, part 4.4, pages 207-211.

Managing breeding habitat is critical to conservation of foothill yellow-legged frog, because individuals are concentrated in both time and space during breeding. The potential loss of adults and young due to a variety of risk factors (e.g. dam releases, all terrain vehicles, mining, grazing, etc.) would be much worse during breeding than at times of the year when frogs and tadpoles are more widely dispersed.

3.2.2.8. Mountain Yellow-Legged Frog (*Rana muscosa*)

This section updates and supplements the information found in the FEIS, volume 3, chapter 3, part 4.4, pages 213-214. New information also comes from the U.S. Fish and Wildlife Service’s (FWS) 12-month finding for the petition to list this species (69 FR 2283-2303) and the Biological Assessment for the SEIS (USDA Forest Service Pacific Southwest Region 2003a).

Life History

In a 12-month finding for a petition to list the mountain yellow-legged frog as a threatened species, the FWS concluded that the Sierra Nevada population is discrete from the southern California population, on the basis of their geographic separation, differences in vocalization, differences between their habitats, and apparent genetic differences (69 FR 2283-2303). The FWS also concluded that the Sierra Nevada population is *significant*, because the loss of the species from the Sierra Nevada would result in a significant reduction in the species’ range and population, and would constitute the loss of a genetically discrete population.

Habitat Relationships

Mountain yellow-legged frogs in the Sierra Nevada live in high mountain lakes, ponds, tarns, and streams—largely in areas that were glaciated as recently as 10,000 years ago (Zweifel 1955). This species is usually associated with montane riparian habitats in lodgepole pine, yellow pine, sugar pine, white fir, whitebark pine, and wet meadow vegetation types (Zweifel 1955, Zeiner et al. 1988).

Alpine lakes used by mountain yellow-legged frogs usually have margins that are grassy or muddy (Zweifel 1955), although the frogs are not limited to this habitat. This species extensively uses deep-water ponds (deeper than 8.2 feet) that have open shorelines and lack introduced fishes (Matthews and Pope 1999, Knapp and Matthews 2000, Knapp 2003). Adults are typically found sitting on rocks along the shoreline, usually where there is little or no vegetation (Wright and Wright 1933). Both larvae and adults prefer open shorelines with gently slope and shallow water 2 to 3” deep (Mullally and Cunningham 1956). Shallow water likely provides a refuge from predation by fish that may be present in adjacent deeper water (Jennings and Hayes 1984). Mountain yellow-legged frogs also use stream habitats, especially in the northern part of their range.

Mountain yellow-legged frogs may use different sites to overwinter, breed, and forage. Because larvae (tadpoles) must overwinter at least once before metamorphosis, it is important for breeding sites to have adequate water depth so that they do not dry in the summer and freeze through in the winter (Bradford 1983). It is also favorable for breeding sites to have some shallow areas with warm water temperatures for optimal larvae development and feeding (Bradford 1984). Larvae are a very sensitive life stage for this species. They are vulnerable to habitat changes, both desiccation and freezing, and high levels of predation. Subadults and adults may use several sites for feeding and then overwintering. Cover is important for movement between and within habitats.

Some of the highest observed densities of frogs have been found both at creek confluences having irregular banks and varying water depths, and in open areas on the edges of glaciated lakes (Mullally and Cunningham 1956). Mountain yellow-legged frog populations seem to be most numerous where predatory fish are absent.

In the Sierra Nevada, adult frogs apparently hibernate during the coldest winter months, probably because they can tolerate only limited dehydration. Larvae and adults generally overwinter under ice. Both adults and larvae have been found to overwinter up to 9 months in the bottoms of lakes at least 5.6 feet deep, and preferably at least 8.2 feet deep, or in rocky streams (Bradford 1983). In some instances, frogs have been found to overwinter in bedrock crevices (Matthews and Pope 1999), which allow them to survive in shallow water bodies that freeze to the bottom in winter (Pope 1999). This behavior may be in response to the presence of introduced fishes that cannot survive in ponds that completely freeze.

Mountain yellow-legged frogs emerge from overwintering sites immediately following snowmelt. Adults sometimes travel over snow to reach preferred breeding sites early in the season (Pope 1999). Breeding activity begins early in the spring and can range from April at lower elevations to June and July in higher elevations (Wright and Wright 1933, Stebbins 1951, Zweifel 1955). The timing of the onset of breeding depends on the amount of snowfall and subsequent thaw dates of ponds, lakes, and streams. In years with particularly cold winters, high elevation frog populations may be active for as little as 90 days during the warmest part of summer (Bradford 1983).

Life history characteristics, such as overwintering under frozen lakes and multi-year larval development, make the mountain yellow-legged frog susceptible to large-scale die-offs. In lakes less than 13 feet deep, overwintering frogs may die apparently due to oxygen depletion, while larvae are able to survive (Bradford 1983). Conversely, in dry years larvae are lost to desiccation in the late summer or fall (Mullally 1959). Knapp (2003) suggests that the number of nearby water sources and proximity to neighboring populations is important to maintain metapopulations.

Status

On February 8, 2000, the Center for Biological Diversity and the Pacific Rivers Council petitioned FWS to list the Sierra Nevada population segment of mountain yellow-legged frog as an endangered species under the Endangered Species Act. On October 12, 2000, the FWS announced a finding that the petition presented substantial information indicating that listing the species may be warranted (65 FR 60606-60605). On January 16, 2003, the FWS completed its 12-month finding and concluded that the petitioned action is warranted but is precluded by higher priority actions to amend the lists of endangered and threatened wildlife and plants (69 FR 2283-2303). The species has, therefore, been added to the FWS candidate species list.

In 1999, a team of agency managers and researchers agreed that a mountain yellow-legged frog conservation assessment and strategy was needed to provide for the protection and conservation of this species. The Forest Service and the California Department of Fish and Game approved preparation of a mountain yellow-legged frog conservation assessment and strategy. In 2000, a working group of biologists from the Forest Service, National Park Service, USDI Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. The conservation assessment is still in preparation and is unavailable for incorporation into this analysis.

The mountain yellow-legged frog is listed on the Region 5 sensitive species list (USDA Forest Service 1998). It is also a State of California species of special concern.

Historical and Current Distribution

The mountain yellow-legged frog was once extremely abundant in aquatic ecosystems of the Sierra Nevada. It was distributed nearly continuously in high elevation water bodies in the Sierra Nevada, from southern Plumas County to southern Tulare County at elevations mostly above 6,000 feet. The historic range of the Sierra Nevada population of mountain yellow-legged frog encompasses 10 national forests (Lassen, Plumas, Tahoe, Lake Tahoe Basin Management Unit, Eldorado, Stanislaus, Toiyabe, Inyo, Sierra, and Sequoia) and 3 national parks (Yosemite, Sequoia, and Kings Canyon).

Since about 1970, mountain yellow-legged frog numbers and populations have undergone a precipitous decline throughout the Sierra Nevada. Further declines continue to be documented. Mountain yellow-legged frogs have disappeared from 70-90% of their historic localities. Remaining populations are widely scattered and consist of few breeding adults.

The distribution of the Sierra Nevada mountain yellow-legged frog is restricted primarily to publicly managed lands at high elevations, including streams, lakes, ponds, and meadow wetlands located on national forests and national parks. Approximately 210 known mountain yellow-legged frog populations (or populations within metapopulations[1]) exist on the national forests within the Sierra Nevada, though not all of these populations may be reproducing successfully.

The FWS estimates that 22% of the remaining mountain yellow-legged frog sites within the Sierra Nevada are found within the national forests while 78% are found within the national parks. These percentages do not reflect the number of individuals present at each site, and they include sites with and without evidence of successful reproduction. The methods for measuring the numbers of populations and metapopulations in the national forests and national parks have not been standardized, and, therefore, caution should be used when comparing national forests numbers to national park numbers.

Risk Factors

A summary of risk factors for this species can be found in the FEIS, volume 3, chapter 3, part 4.4, pages 213 -215.

[1] A metapopulation is a set of partially isolated populations belonging to the same species. The different populations are able to exchange individuals and recolonize sites in which the species has recently become extirpated (eliminated).

Numerous factors, separately and in combination, have contributed to the species' decline. Introduction of non-native fishes, pesticides, ultraviolet radiation, pathogens, acidification from atmospheric deposition, nitrate deposition, livestock grazing, recreational activities, and drought have all been identified as potential factors impacting this species and its habitat. Because many of the remaining populations of Sierra Nevada mountain yellow-legged frog are small isolated remnants, they are vulnerable to random natural events that could quickly extirpate them. It is widely recognized that, in general, small populations are more vulnerable to extinction than large ones and one study (Knapp 2003) suggests this species exhibits and is likely dependent upon metapopulation dynamics. Four major factors have been identified that predispose small populations to extinction, including

- environmental variation and natural catastrophes, such as unusually harsh weather, fires, or other unpredictable environmental phenomena;
- chance variation in age and sex ratios or other population parameters (demographic stochastisity);
- genetic deterioration resulting in inbreeding depression and genetic drift (random changes in gene frequencies); and
- disruption of metapopulation dynamics (i.e. the extinction-colonization balance among interconnected populations is disrupted).

3.2.2.9. Yosemite Toad (*Bufo canorus*)

The *habitat relationships* and *historical and current distribution* sections were inadvertently omitted from the FEIS. This section updates and supplements the information found in FEIS volume 3, chapter 3, part 4.4, pages 218-219. Additional information is provided from the 12 month finding for a petition to list this species (67 FR 75834-75843) and the Biological Assessment prepared for the SEIS (USDA Forest Service Pacific Southwest Region 2003a)

Habitat Relationships

The Yosemite toad has been found in a wide variety of high montane and subalpine lentic (standing or slowly moving water) habitats including wet meadows, lakes, and small ponds, as well as in shallow spring channels, side channels of streams, and sloughs. The species is most commonly found in areas of shallow, warm water, including wet meadows, small permanent and ephemeral ponds, and shallowly flooded grassy areas and meadows adjacent to lakes (Karlstrom 1962). Some evidence indicates that toad populations may have been more abundant in lake environments than they are currently. Meadow habitats are often surrounded by lodgepole (*Pinus contorta*) or whitebark (*P. albicaula*) pines. A recent study of Yosemite toads in Yosemite National Park (Knapp 2003) suggests that probability of occurrence is related to elevation, amount of meadow vegetation, and survey dates. That study did not find a significant correlation with water depth, littoral zone substrate, or the presence, or absence of non-native fish.

Suitable breeding sites generally are found in shallow water at the edges of meadows, seasonally flooded meadows, slow-flowing shallow spring channels, and runoff streams (Karlstrom 1962). Tadpoles also have been observed in shallow ponds and shallow areas of lakes (Mullaly 1953). Short emergent sedges, few-flowered spike rushes, and other rushes often dominate breeding sites (Karlstrom 1962, Jennings and Hayes 1994). In one study, breeding ponds were usually less than 12 inches deep (Mullaly 1953). Persistence of water and warmer temperatures conducive to tadpole development contribute to successful recruitment. Researchers have found that toads prefer shallow-water breeding sites and tadpoles prefer warm shallow margins during the day (Karlstrom 1962). Thus, water depth and temperature appear to be important limiting factors in the survival of eggs and tadpoles (Kagarise and Morton 1993).

The Yosemite toad is an explosive breeder, laying eggs at snowmelt over a short period of time. They emerge from winter hibernation as soon as snow melt pools form near their overwintering sites

(Karlstrom 1962, Kagarise 1980, Jennings and Hayes 1994). Observed emergence times range from early May to mid June, and breeding begins soon after emergence.

Metamorphs overwinter their first year in their natal meadow and appear to move upland during mid-summer of their second year (Kagarise 1980, Kagarise and Morton 1993). In meadows, metamorphs and yearlings appear to be associated with willows, long sedges, and grasses (D. Martin, unpublished data). Metamorphs can routinely be found throughout the summer months in moist and wet meadow areas, particularly where they meet the mudflat margins of their breeding areas. Tadpoles can metamorphose anywhere from mid-July at the lowest elevations in the driest years to late August in wetter years at the highest elevations (G. Milano, personal communication 2003). Metamorphosis dates will vary from one breeding pool to the next, depending on when eggs were laid.

After breeding, adults feed in meadow habitat or move into other aquatic habitat away from meadows, such as headwater springs. Most studies have found the toad to be diurnal (Karlstrom 1962, Kagarise 1980), however, a recent telemetry study found them to be active at night (D. Martin, unpublished data).

One study found that adults have high site fidelity. Adults bred at the same ponds in successive years, and, after breeding, tended to use the same one or two locations for daytime refuge (Kagarise 1980). Some subadults moved from rearing ponds to different sites for breeding (D. Martin, unpublished data).

Overwintering habitat requirements are poorly understood, but it is generally assumed that Yosemite toads overwinter in rodent burrows (Jennings and Hayes 1994).

Status

On April 3, 2000, the U.S. Fish and Wildlife Service (FWS) received a petition from the Center for Biological Diversity and Pacific Rivers Council to list the Yosemite toad as endangered (67 FR 75834-75843). The petitioners also requested that critical habitat be designated concurrent with listing. On December 10, 2002, the Fish and Wildlife Service published a twelve-month finding regarding the petition (67 FR 75834-75843) concluding that the proposal to list the Yosemite toad as endangered or threatened is warranted but is precluded by other higher priority listing actions. The species has been added to the FWS candidate species list. The Yosemite toad is a Forest Service sensitive species in Region 5.

The SNFPA ROD includes a commitment to develop a conservation assessment for several aquatic and riparian species, including this species. A working group of biologists from the Forest Service, National Park Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. The conservation assessment is still in preparation and is unavailable for incorporation into this analysis.

Historical and Current Distribution

Yosemite toads are known from 292 sites throughout their historic range, 229 of which have been confirmed occupied since 1990. Known locations are based on the most comprehensive dataset on Yosemite toad localities available, which was compiled by the Forest Service for developing a conservation assessment of the species as required by the SNFPA ROD. This dataset comes from various sources, including University of California and California State University researchers, the California Academy of Science, the National Park Service, the U.S. Geologic Survey, the California Department of Fish and Game, and the California Natural Diversity Data Base.

The historic and current acreage of suitable habitat (wet meadows, shallow breeding waters, and moist uplands) within the historic range of the Yosemite toad is unknown, although these habitats have been degraded from historic conditions and may be decreasing in area as a result of conifer encroachment and current and historic livestock grazing. About 99% of the land within the range of the species is federally managed (1,603,903 acres) as follows: national forest—70% of species range, national park—29% of species range, and Bureau of Land Management—less than 1% of species range. Much of this land is within designated wilderness. The remaining land (less than 1% of species range) is in a mix of ownerships, including California Department of Parks and Recreation, California State Lands Commission, city and county governments, and private entities.

The following discussion is based on the best available information. Surveys are ongoing and some sites may not have yet been reported and added to the database. Also, for purposes of this discussion, multiple sightings in close proximity to each other have been considered to constitute a single site. The species has been detected in a few locations outside of its expected range, primarily at the southern end of the range. Table 3.2.2.8a lists known occurrences in the SNFPA planning area.

Table 3.2.2.8a. Yosemite Toad Occurrences in the Sierra Nevada.

Location	Total Sites	Sites Occupied Since 1990
Eldorado NF; southeast corner bordering Toiyabe and Stanislaus NFs	3	2
Toiyabe NF: west side	25	15
Stanislaus NF: a) northern edge where it borders Eldorado and Toiyabe NFs; and b) band extending west from ithe southeast border with Yosemite National Park and Toiyabe NF	28	22
Inyo NF: west side	49	35
Sierra NF: throughout	91	84
Yosemite NP: throughout	78	57
Kings Canyon NP: northern half	18	14

(Source: USDI Fish and Wildlife Service 2002b)

It is impossible to fully determine the extent to which Yosemite toad populations have declined due to the small amount of baseline data pertaining to the number and size of historic populations. The following studies, which reassess the current status of historically documented populations, give the most insight into the species' decline.

Based on museum records of historic and recent sightings, published and unpublished data, and field notes from knowledgeable biologists, 55 historically documented general localities throughout the range of the species (based on 144 specific sites) were surveyed (Jennings and Hayes 1994). The survey showed that Yosemite toads are now absent from 29 of those localities, indicating a population decline of over 50%. In 1990, 75 sites with historic records of occurrence were surveyed; 47% of those sites showed no evidence of any life stage of the species, indicating a population decline of about 63% (Stebbins and Cohen 1997). The species has declined or disappeared completely from at least 9 of 13 sites occupied in 1924 (69%), and abundance is low at most sites (Grinnell and Storer 1924, Drost and Fellers 1994, 1996).

The only long-term study of the size of a Yosemite toad population indicates that the population has declined substantially. Studies of Yosemite toads at Tioga Pass Meadow (Mono County, California) showed substantial declines between the late 1970's and the early 1980's, with the population nearly becoming extirpated. Similar trends have been observed for other areas in the eastern Sierra Nevada (Kagarise and Morton 1993).

Substantial areas have been surveyed for this species since the signing of the ROD (USDA Forest Service Pacific Southwest Region 2003a). Most of the livestock grazing allotments will have required surveys completed by the end of 2004. Many of the areas of suitable habitat used by recreational pack stock occur in remote high country areas. Surveys of some of these areas have been completed; however, surveys will likely not be completed until at least 2006 for all of these sites.

Risk Factors

The U.S. Fish and Wildlife Service's 12-month petition finding for the Yosemite toad (67 FR 75834-75843) cites all relevant research, unpublished data, and observations by researchers and managers, and reveals the potential adverse effects of multiple stressors on species populations and long-term species viability. These multiple stressors may be working singly or in combination at various landscape scales, from local breeding ponds to rangewide, to decrease the species vigor to withstand population reductions and extirpation events caused by disease, weather, and predation.

Activities potentially impacting this species and its habitat include livestock grazing; commercial and recreational pack stock grazing; recreational use of meadows; hiker and stock trail development and use; predation from introduced non-native fish species; forest management actions; herbicide and pesticide applications; pesticide drift from Central Valley agricultural areas; drift of automobile exhaust pollutants; disease as a result of fungal, bacterial, and other parasitic infections; long-term drought and climate change; and, possibly, recent increases in UV radiation.

In addition to the risk factors noted in the FEIS (volume 3, chapter 3, part 4.4, pages 218-219), other potential impacts to this species and its habitat include

- decreased growth rate of tadpoles as a result of increased bacteria from livestock fecal matter;
- mortality from being buried by livestock feces;
- reduced vegetative hiding cover for metamorphs, juveniles, and adults, which increases their vulnerability to predation by snakes and birds; and
- the collapse of rodent burrows from livestock hoof punching, thereby entrapping or burying individuals that use burrows for hiding cover.

The effect of these risk factors on the viability of the Yosemite toad is unknown. These factors have been identified from researchers' unpublished data and personal communications, as well as resource managers' observations, and have not been thoroughly investigated by researchers.

Trails used by hikers, pack stock, and livestock are commonly associated with occupied Yosemite toad meadows. Metamorphs have been observed to cluster on moist or wet trail segments in and on the edges of meadows and direct mortality of metamorphs from trampling has been observed (G. Milano, personal communication 2003). Occasionally, juveniles and adults have also been observed on the trail tread. Metamorphs, at 10 mm. long, are difficult to see. In addition, poorly designed or maintained trails in Yosemite toad habitat can result in accelerated sediment input into pools and can dry out wet and moist portions of habitats where trails are diverting water away from meadows.

Research on the effects of environmental toxins on this species has also not been conducted. The Pacific chorus frog was shown to have lowered levels of cholinesterase, an enzyme of importance to the nervous system, and other amphibians have shown sensitivity to numerous pesticides, herbicides, and fertilizers (Sparling et al. 2001).

Forest Service management can influence the following stressors: chemical toxins from localized pesticide and herbicide application, livestock grazing, commercial and recreational pack stock grazing, recreational use of meadows, hiker and stock trail development and use, fish stocking, and disease spread as a result of Forest Service activities. Forest Service management can also affect genetic diversity of the species, which is important for long-term population viability. Due to the limited extent of existing populations, management approaches should aim to maintain all known populations at each breeding area; this will reduce the risk that genetic diversity is diminished sufficiently to compromise genetic vigor of the species. In addition, Knapp (2003) suggests that this species depends upon metapopulation dynamics and management should focus on maintaining connections between individual populations to allow inter-site dispersal.

3.2.2.10. Northern Leopard Frog (*Rana pipiens*)

The *life history*, *habitat relationships*, and *historical and current distribution* sections were inadvertently omitted from the FEIS. This section updates and supplements the information found in the FEIS volume 3, chapter 3, part 4.4, page 226.

Life History

Breeding

The species is generally active from March through November, depending upon climate (Pace 1974, Merrell 1977). Although they depend upon wet areas, they can be found far from water bodies during summer (Zenisek 1963, Dole 1967, Pace 1974, Merrell 1977, Hine et al. 1981). Leopard frogs generally do not lay their eggs until the water temperature remains at least 46 to 55 degrees F. for about 10 days (Merrell 1977, Hine et al. 1981, Gilbert and Fortin 1994). Males usually reach sexual maturity and begin breeding in one year, whereas females usually mature their second spring after metamorphosis (Force 1933, Dole 1965, Gilbert and Fortin 1994). Egg masses are attached to aquatic vegetation from 4 to 25 inches below the surface, usually in a shallow, warm area of the breeding pond (Zenisek 1963, Pace 1974, Merrell 1977, Hine et al. 1981, Gilbert and Fortin 1994, Degenhardt et al. 1996, Hammerson 1999). Eggs hatch approximately 14-16 days after oviposition depending upon temperatures (Hammerson 1999). Tadpoles metamorphose 3-6 months after hatching, and this process usually coincides with the onset of cooler temperatures in the late summer and early fall (Zenisek 1963, Hine et al. 1981, Merrell 1977). After oviposition, adults leave the water and live almost exclusively in moist grassy areas surrounding the breeding pool or other nearby water sources (Dole 1967). Summer movements are generally restricted to short distances. During nocturnal rains they are known to travel long distances (Merrell 1977). In late fall, leopard frogs return to permanent water sources (Pace 1974).

Three factors appear to be important habitat components for this species: grass, water, and emergent vegetation (Hitchcock 2001). Other factors that appear important include habitat size, bank height, percent cover of algal mats, and emergent vegetation (Hitchcock 2001).

Mortality

Most mortality of leopard frogs occurs in the tadpole stage. Waterfowl, fish, bullfrogs, and aquatic insects are probably responsible for much of this mortality. Adults are eaten by snakes during the summer and fall months. Garter snakes (*Thamnophis* spp.) are probably a common predator of leopard frogs. Because leopard frogs migrate between breeding, summering, and overwintering habitats, vehicles on roads can be a significant cause of mortality. Roads built between ponds and larger water bodies can result in large numbers of vehicle-killed leopard frogs. The lack of oxygen in water inhabited by overwintering leopard frogs has resulted in large winter kills as well.

Tadpoles may be eaten by numerous vertebrates and invertebrate predators and by native and introduced fish. As with other native amphibian species, it is thought that introduced fish have resulted in adverse direct and indirect effects on amphibian populations, which also may be true for the northern leopard frog. Drought is apparently an important source of mortality as well. Corn and Fogleman (1984) document local extirpation of leopard frogs when drought dried ponds in the fall and winter months. In one year, Hine et al. (1981) found that two of five breeding ponds did not produce young because they dried up prior to metamorphosis. They also found that in 1976, during the worst drought in the century, only 4 of 23 ponds having breeding activity produced frogs.

Habitat Relationships

The northern leopard frog has been called the “meadow frog” for its summertime movements away from ponds. They may range widely into a wide variety of habitats, including hay fields and grassy woodlands, but apparently they prefer to be concealed in dense vegetative cover.

In Minnesota, the typical breeding pond of leopard frogs is a “temporary pond with a maximum depth of 5 - 6 ft, that does not support a fish population, is not connected with any other body of water, and dries up periodically every few years” (Merrell 1977). The distance between overwintering and breeding sites is typically 0.6-1.2 mi in Minnesota.

These frogs commonly emerge in early spring (March or April), and males immediately begin calling for mates. During this time, frogs are concentrated in or around lentic water bodies, where courtship and spawning takes place. After breeding, adult leopard frogs move away from ponds to a variety of habitats nearby. The distribution appears to be related to a variety of factors, including available food, adequate cover, and moisture. Little information from the Sierra Nevada is known about their dispersal; however, in other areas they have been found several feet to as much as 1 mile away from ponds. They avoid areas with grass over 3 feet tall, wooded areas, open areas lacking vegetation, or heavily grazed or mowed areas. Leopard frogs usually move at night and in summer will move most on rainy days.

After metamorphosis, young frogs may emigrate from their breeding ponds to more permanent water features, such as a lake or stream. Small frogs often congregate along the shores of these water features. They appear to segregate from larger frogs by remaining at the water’s margin. Emigration occurs in late July in Minnesota and early July in Iowa (Merrell 1977).

Movements in the fall begin with cooler weather, often in September. Movement generally takes place at night, but frogs may move on dark, rainy days as well. Overwintering occurred between the months of October and April in Minnesota (Merrell 1977). Overwintering habitats are larger lakes and streams that do not freeze completely during winter. Leopard frogs do not hibernate during winter but their activity is much reduced. Frogs can be found wintering among stones, sunken logs, leaf litter, or depressions in bottom vegetation.

Status

The SNFPA ROD includes a commitment to develop a conservation assessment for several aquatic and riparian species, including the northern leopard frog. A working group of biologists from the Forest Service, National Park Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. The conservation assessment is still in preparation and is unavailable for incorporation into this analysis.

The northern leopard frog is listed on the Region 5 sensitive species list. In addition, the species is a State of California species of special concern.

Historical and Current Distribution

According to records from major U.S. museums, northern leopard frogs historically inhabited several isolated locations of California, with most populations in or near the Sierra Nevada. Populations were clustered in three main areas: south of Goose Lake (in the vicinity of Alturas in Modoc County), Lake Tahoe (El Dorado County), and near Bishop (Inyo County).

The most recent records of the species’ occurrence—near Tule Lake in Siskiyou County in 1990 and in Round Valley near Bishop in Inyo County in 1994—are the only records of occurrence in California in over two decades. These locations are within two of the three main historical clusters in the state. However there have been no systematic field verifications of historical northern leopard frog locations in California. Some individual sightings may be of captive frogs released into the wild by individuals. It is therefore impossible, therefore, to determine whether this species is currently viable or even extant.

Risk Factors

For a summary of risk factors, see the FEIS, volume 3, chapter 3, part 4.4, page 226.

3.2.2.11. Cascades Frog (*Rana cascadae*)

The *life history*, *habitat relationships*, and *historical and current distribution* sections were inadvertently omitted from the FEIS. This section updates and supplements the information found in the FEIS, volume 3, chapter 3, part 4.4, page 223.

Life History - Mortality

Known natural predators on this species include rough-skinned newt, garter snakes, black bear, raccoon, mink, and coyote, and introduced trout (Briggs and Storm 1970, Peterson and Blaustein 1991, Fellers and Drost 1993, Hokit and Blaustein 1995). Tadpoles are also prey of aquatic insect larvae, several species of birds, and salamander larvae (O'Hara 1981).

These frogs are also susceptible to mortality from disease. Mass mortality of developing eggs in Oregon has been documented and linked to the pathogenic fungus, *Saprolegnia ferax* (Blaustein et al. 1994). Because the frogs lay eggs in communal egg masses, they are extremely susceptible to *Saprolegnia* (Kiesecker and Blaustein 1997). This common fish pathogen may be introduced by fish into lakes and ponds during fish stocking (Seymour 1970, Richards and Pickering 1978, Blaustein et al. 1994). *Saprolegnia* has not been found in California.

Life history characteristics—such as over-wintering under frozen lakes and ponds, larval development in ephemeral ponds that may dry up before metamorphosis, and multi-year larval development in high elevation sites—make the species susceptible to die-offs due to extreme winter or drought conditions (Sype 1975, O'Hara 1981).

Habitat Relationships

Cascades frogs are highly aquatic and are found in or around ephemeral and permanent water sources including wet meadows, marshes, ponds, creeks, and lakes. Breeding sites are found in vegetated ponds, potholes, flooded areas in meadows, and shallow alcoves of lakes that generally contain protected, gently sloping shallow areas close to shore.

Breeding habitat is less well-defined in California than in Oregon and Washington, where more research has been conducted. A recent study conducted in the Klamath Mountains of California found that Cascades frogs primarily breed in lakes, ponds, and wet meadows that are fish-free and contain a high percentage of silt in near-shore areas (Welsh unpublished data). The three known remaining reproductive sites on the Lassen National Forest are in springs or wet meadows adjacent to streams, or in headwater shallow ponds. Because these are the only remaining breeding populations of a historically common frog in the Mount Lassen area, interpretations about general habitat associations in this region should be made with caution.

Adults and juveniles use a wider variety of habitats than those used for breeding, such as ponds, meadows, deep lakes, and creeks. In Washington, adults were found in a high proportion of lakes, ponds, meadows, and streams (Bury and Major 1997). Microhabitat of adults has not been well-studied, but adults seem to prefer sites with open, sunny areas along shorelines for basking. Adults and subadults are often found along small side channels of creeks having muddy substrate that provides cover.

Little is known about overwintering habitat. Frogs are believed to overwinter in sediment on the bottom of frozen lakes and ponds or in ground saturated with spring water (Briggs 1987).

Cascades frogs are relatively long-lived and late maturing. In one study in Oregon, 6 and 7 year old males and females were found at one site (Olson 1992). Ages at maturity are estimated to be at least 3 years for males and 4 years for females (Briggs and Storm 1970, Olson 1992). The frog has a high degree of site fidelity (Briggs and Storm 1970, Olson 1992). Adults are diurnally active and bask and feed along the shoreline of lakes, ponds, streams, and wet meadows.

Status

The SNFPA ROD includes a commitment to develop a conservation assessment for several aquatic and riparian species, including the Cascades frog. A working group of biologists from the Forest Service, National Park Service, U.S. Fish and Wildlife Service, and California Department of Fish and Game and research scientists was established to complete this effort. The conservation assessment is still in preparation and is unavailable for incorporation into this analysis.

The Cascades frog is listed on the Region 5 sensitive species list. It is also a State of California species of special concern.

Historical and Current Distribution

The Cascades frog is distributed along the Cascade Range from northern California to northern Washington, with a disjunct population on the Olympic Peninsula in Washington (Jennings and Hayes 1994, Blaustein et al. 1995, Stebbins 1985). In California, populations were historically distributed from the Shasta-Trinity area to the Modoc plateau. The southward extent was the Mount Lassen and upper Feather River regions. The known elevational range in California was from around 750 feet at Anderson Fork, Butte County, to 8000 feet at Emerald Lake in Lassen Volcanic National Park. The species range has traditionally been described as two disjunct populations, one centered around the Lassen area and the other in the Klamath area. However, this description may represent anecdotal and historic knowledge of their distribution. The frog's distribution in California is poorly understood.

In northern California, north of the McCloud River, Cascades frog populations appear to be viable. At historical localities in the upper McCloud River system and extending to the Trinity Alps, the frog was found to be moderately to extremely abundant in areas with no fish. In the southern-most part of its range (south of the McCloud River); however, recent research has shown that this frog is extremely rare.

Cascades frogs historically were known to occur within the project area on the western part of the Lassen National Forest. Even within the Forest, the species was isolated to Deer Creek, Butte Creek, Mill Creek and Battle Creek. Additional populations were noted on the West Branch Feather River and Upper, Middle, and Lower North Fork Feather River. Critical Aquatic Refuges have been established for known reproducing populations of Cascades frogs on the Lassen. The species may also occur on the Plumas National Forest, along the border with the Lassen National Forest in Little Grizzley Creek.

Risk Factors

For a summary of risk factors see FEIS, volume 3, chapter 3, part 4.4, page 223.

The Cascades frog may undergo severe population fluctuations caused by natural stochastic events such as drought and prolonged winters. Because many of the remaining populations in the Mount Lassen area, Russian Wilderness, and Marble Mountains are small isolated remnants, they are vulnerable to random natural events that could quickly extirpate them.

3.2.3. Management Indicator Species

The FEIS included a process of evaluating effects of proposed activities on all species known to occur in the planning area. This process was used to identify high vulnerability species based upon projected habitat trends and is described in detail in the FEIS in volume 3, chapter 3, part 4 (particularly part 4.1 and 4.5) and in Appendix R of the FEIS. This SEIS evaluates new information available since the adoption of the SNFPA ROD and proposes to make changes in specific standards and guidelines and clarifications and minor modifications to other aspects of the current management direction. Since the planning area and scope of activities proposed in the SEIS alternatives lies within the range of conditions contemplated in the FEIS, the evaluation of effects for most of the species as originally completed remains applicable. The evaluation for the SEIS alternatives, therefore, does not repeat the analysis of the FEIS but instead focuses on those management indicator species (MIS) that may be affected by changes in habitat or levels of activity as a result of the proposed alternatives.

MIS are identified in the Land and Resource Management Plans of each national forest and are generally identified to represent habitat types that occur within the national forest boundary and/or because they are thought to be sensitive to National Forest System management activities. In order to evaluate the effects of the proposed alternatives on MIS, the MIS list from each affected forest was reviewed to develop the list of species to be addressed. For this analysis, federally listed threatened, endangered, or proposed species and Forest Service sensitive species were excluded from further evaluation because effects to those species are considered in more detail in the FEIS, in this SEIS, and in the biological assessments and biological evaluations for these documents. For the remaining MIS species, the CWHR System personal computer database (California Department of Fish and Game 2002) was reviewed to assign each species to one or more primary habitat association as shown in Table 3.2.3a. This was done because current lists of MIS in individual forest plans vary from forest to forest in terms of habitat representation or sensitivity to management activity across the Sierra Nevada bioregion. The habitat associations for species used here may not match those of the individual forest plans. In addition, some national forests identified species assemblages in lieu of or in addition to individual species. A complete list of MIS species and species assemblages from each national forest land and resource management plan is available in the project record.

Background biological information for MIS species (life history, distribution and range, habitat requirements) is either described in the FEIS (volume 3, chapter 3, parts 4.2 or 4.5) or is contained in the available literature, such as species accounts contained in the CWHR System and associated publications (California Department of Fish and Game 2002; Zeiner et al 1990a, 1990b, 1990c). The distribution and range maps from the CWHR System were used to evaluate distribution of the species across the bioregion.

Table 3.2.3a. Management Indicator Species and Corresponding Habitats.

Species	CWHR Identifier	Snag and Down Log (Cavity-Nesters)	Meadow	Riparian (Wetlands)	Aquatic (Lakes/Streams)	Chaparral	Cliff, Caves, Talus, and Rock Outcrops	Hardwoods (Oaks, Aspen)	Openings and Early Seral Stages	Pinyon Juniper	Eastside Pine	Ponderosa Pine	Grasslands and Shrub-Steppe	Mature Conifer	Multi-Habitat	Mixed Conifer
Ensatina	A012													X		
Pacific tree frog	A039		X	X	X											
Black-throated gray warbler	B436							X		X						
Band-tailed pigeon	B251							X								X
Black-headed grosbeak	B475			X				X		X						X
Blue grouse	B134															X
Brown creeper	B364	X										X				X
Bufflehead	B103				X											

Species	CWHR Identifier	Snag and Down Log (Cavity-Nesters)	Meadow	Riparian (Wetlands)	Aquatic (Lakes/Streams)	Chaparral	Cliff, Caves, Talus, and Rock Outcrops	Hardwoods (Oaks, Aspen)	Openings and Early Seral Stages	Pinyon Juniper	Eastside Pine	Ponderosa Pine	Grasslands and Shrub-Steppe	Mature Conifer	Multi-Habitat	Mixed Conifer
Calliope hummingbird	B289		X	X					X							
Canada goose	B075			X	X											
Cassin's finch	B537		X	X							X					
Cinnamon teal	B083				X											
Downy woodpecker	B303	X		X												
Golden eagle	B126						X						X			
Golden-crowned kinglet	B362													X		X
Great blue heron	B051	X			X											
Hairy woodpecker	B304	X														X
Hammond's flycatcher	B317											X				X
House wren	B369			X				X								
Lincoln's sparrow	B506			X												
Mallard	B079				X											
Mountain bluebird	B381	X														
Mountain quail	B141					X										X
Northern flicker	B307	X														X
Northern oriole	B532			X				X								
Osprey	B110				X											
Pacific-slope flycatcher	B320			X				X								X
Pileated woodpecker	B308	X												X		
Prairie falcon	B129						X						X			
Red crossbill	B539															X
Red-breasted nuthatch	B361	X														X
Red-breasted sapsucker	B299	X						X								X
Red-naped sapsucker	B298	X														X
Sharp-shinned hawk	B115			X							X		X			X
Song sparrow	B505		X	X												
Three-toed woodpecker	B306	X												X		
Townsend's warbler	B437								X							X
Violet-green swallow	B340	X														
White-breasted nuthatch	B362	X						X								X
White-crowned sparrow	B510		X	X												
White-headed woodpecker	B305	X														X
Wild turkey	B138							X	X				X			X

Species	CWHR Identifier	Snag and Down Log (Cavity-Nesters)	Meadow	Riparian (Wetlands)	Aquatic (Lakes/Streams)	Chaparral	Cliff, Caves, Talus, and Rock Outcrops	Hardwoods (Oaks, Aspen)	Openings and Early Seral Stages	Pinyon Juniper	Eastside Pine	Ponderosa Pine	Grasslands and Shrub-Steppe	Mature Conifer	Multi-Habitat	Mixed Conifer
Williamson sapsucker	B300	X									X					X
Wilson's warbler	B463			X												
Winter wren	B370			X												X
Wood duck	B076				X											
Yellow warbler	B430			X												
Yellow-bellied sapsucker	B709	X														
Nelson bighorn sheep (Desert)	M183												X			
Black bear	M151		X					X						X	X	X
Bobcat	M166														X	
Douglas squirrel	M079	X						X						X		X
Dusky shrew	M004			X												
Dusky-footed woodrat	M127					X			X							
Elk	M177			X					X				X	X		
Mountain beaver	M052		X	X												
Mountain lion	M165														X	
Mule Deer	M181								X						X	
Northern flying squirrel	M080	X												X		
Ornate shrew	M006			X												
Pronghorn	M182									X						
Raccoon	M153			X											X	
Vagrant shrew	M003		X	X												
Water shrew	M010		X	X	X											
Western gray squirrel	M077							X						X		X
Western jumping mouse	M143		X	X												
California mountain kingsnake	R059					X		X								X
Gopher snake	R057					X							X		X	
Rubber boa	R046		X	X										X	X	
Western aquatic garter snake	R063		X	X	X											
Western skink	R036								X							
Western terr. garter snake	R069		X	X												

(Sources: California Department of Fish and Game 2002; Zeiner et al 1990a, 1990b, 1990c)

Population data exists for some of the species considered in this analysis, primarily game species managed by the state wildlife agencies and landbird species collected through breeding bird survey routes and other constant effort surveys within and adjacent to NFS lands. This population data is generally either applicable only to local populations, in the case of most game species surveys, or in aggregate across the Sierra Nevada bioregion in the case of breeding bird survey routes. Population data is generally lacking for the remaining MIS. Specific population data from individual surveys was not used for this analysis, rather synthesized population trends were extracted from published literature and reports where it was available as shown in Table 3.2.3b.

Table 3.2.3b. Population Trend Information for Selected MIS.

Species	Trend
Black-throated gray warbler	Possibly Stable
Band-tailed pigeon	Negative
Blue grouse	Increasing Tendency
Brown creeper	Possible Decrease
Cassin's Finch	Likely Decreasing
Golden-crowned kinglet	Likely Decreasing
Great gray owl	Insufficient Data
Hairy woodpecker	Likely Stable
Hammond's flycatcher	Stable
Lincoln's sparrow	Insufficient Data
Mallard	Increasing
Mountain quail	Stable
Northern flicker	Stable
Northern goshawk	Insufficient Data
Northern oriole	Insufficient Data
Pacific-slope flycatcher	Increasing Tendency
Pileated woodpecker	Decreasing Tendency
Red crossbill	Possibly Increasing
Red-breasted nuthatch	Likely Stable
Red-breasted sapsucker	Possibly Decreasing
Red-naped sapsucker	Insufficient Data
Song sparrow	Increasing Tendency
Violet-green swallow	Decreasing Tendency
White-breasted nuthatch	Possibly Decreasing
White-headed woodpecker	Possibly Increasing
Willow flycatcher	Insufficient Data
Wilson's warbler	Decreasing Tendency
Winter wren	Possibly Decreasing
Yellow warbler	Possibly Decreasing
Black bear	Increasing
Wild Turkey	Increasing
Mule Deer	Variable

(Source: California Department of Fish and Game 1998a, 1998b, 2003; California Partners in Flight 1999)

It should be recognized that existing population data and projected population trends suitable for use at a bioregional scale are not suitable for determination of cause and effect relationships. Confounding variables such as intermixed public and private land ownership patterns, variable land histories and changes in habitat, stochastic environmental variables such as habitat disturbances from fire and climate change, and effects that occur off the national forests make it difficult, if not impossible, to determine the cause of changes in population trend. For example, population trends from breeding bird surveys are derived from aggregating data across many individual survey routes which occur across both National Forest System lands and private lands. While some factors, such as survey methodology are controlled to limit variability, changes in habitat or populations that may be occurring differentially between public and private land cannot easily be distinguished in the derived population trends. For migratory species, it is even more difficult to isolate possible causal factors related to changes in population trend due to the possibility of effects in distant locations along the migratory path. Nonetheless, general ecological theory suggests that changes in availability in overall habitat would be expected to change population capacity, at least at the local scale.

An additional 13 habitat assemblages are identified to represent MIS in various Sierra Nevada national forests. These habitat assemblages are shown in Table 3.2.3c.

Table 3.2.3c. MIS Assemblages for Various Sierra Nevada National Forests.

MIS Assemblages
Hardwood Species Assemblage
Mature Eastside Pine Species Group
Mature Mixed-Conifer Avian Species
Mature/Old-Growth Forest, Mixed Conifer Species Group
Mature/Old-Growth Forest, Red Fir Species Group
Meadow Edge Avian Species
Mountain Meadow Species Group
Oak Woodland Avian Species
Riparian Bird Assemblage
Riparian Wildlife Assemblage
Trout
Wetlands Species Group
Cavity Nesting Birds

(Source: USDA Forest Service Pacific Southwest Region 2003b)

These assemblages correspond with the original five problems areas of the SNFPA FEIS: old forest ecosystems; aquatic, riparian, and meadow ecosystems; fire and fuels; noxious weeds and invasive nonnative plants; and hardwood ecosystems. Alternative S1 was found to respond to these five problem areas which should ensure maintenance and restoration of their associated habitats.

Vegetation management, fuels treatment, and grazing practices included in the alternatives of this SEIS could affect most of the broad habitat types found within the planning area, with the exception of the cliff, caves, talus, and rock outcrop and the aquatic (lakes and streams) types. Therefore, no additional analysis is conducted for species associated primarily with these habitat types as population trends of these species are not expected to be affected by activities proposed in the alternatives. Little scientific study to describe specific habitat relationships and relationships to management activities has occurred for most of the MIS that do not have special management status (federally listed, Forest Service sensitive, state game species), making it difficult to assessing specific risk factors other than generalized risks from loss or alteration of habitat based upon general ecological theory.

Population data exists for some of the species considered in this analysis, primarily game species managed by the state wildlife agencies and landbird species collected through breeding bird survey routes and other constant effort surveys within and adjacent to NFS lands. This population data is generally either applicable only to local populations, in the case of most game species surveys, or in aggregate across the Sierra Nevada bioregion in the case of breeding bird survey routes. Population data is generally lacking for the remaining MIS. Specific population data from individual surveys was not used for this analysis. Synthesized population trends were extracted from published literature and reports where this information was available.

It should be recognized that existing population data and projected population trends suitable for use at a bioregional scale are not suitable for determination of cause and effect relationships. Confounding variables such as intermixed public and private land ownership patterns, variable land histories and changes in habitat, stochastic environmental variables (i.e. habitat disturbances from fire and climate change) and effects that occur off the national forests make it difficult, if not impossible, to determine the cause of changes in population trend. For example, population trends from breeding bird surveys are derived from aggregating data across many individual survey routes, which occur across both National Forest System lands and private lands. While a survey protocol controls aspects of observer and process variability, because of the land ownership patterns, the variability in species detections from habitats that are a result of different land management activities and objectives is not directly controlled. When detections from points within a route that survey multiple land ownership are combined to generate route totals, and when several survey routes are combined to evaluate population trends across the Sierra Nevada bioregion, it becomes difficult to distinguish if population trends are equally affected by activities from private lands versus public lands. For migratory species, it is even more difficult to isolate possible causal factors related to changes in population trend due to the possibility of effects in distant locations along the migratory path. Nonetheless, general ecological theory suggests that changes in availability in overall habitat would be expected to change population capacity, at least at the local scale.

3.2.4. Neotropical Migratory Birds

Neotropical migratory birds are birds which breed in North America and migrate outside of the continental U.S. during the non-breeding season. The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712, July 3, 1918, as last amended in 1989) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the act, taking, killing, or possessing migratory birds, including nests and eggs, is unlawful. The species protected by this law extend beyond those normally considered migratory, to include species that occur in the U.S. and the other neighboring countries at some point during their life cycle.

In 2001, Executive Order 13186 was issued to outline responsibilities of federal agencies to protect migratory birds under the Migratory Bird Treaty Act (66 FR 3853-3856). The executive order directs federal agencies to work with the FWS to promote conservation of migratory bird populations.

To help implement the executive order, the Forest Service and FWS entered into an interim memorandum of understanding (MOU) having the purpose of strengthening migratory bird conservation through enhanced collaboration between the two agencies in coordination with state, tribal, and local governments. Although this interim MOU expired on January 15, 2003, the conservation measures that it contained are still applicable for use in environmental planning today. The MOU continues to provide guidance for the two federal agencies until more detailed direction is developed pursuant to the executive order.

The number of neotropical migratory birds found within the Sierra Nevada bioregion is large. They use a broad array of habitat associations. However, the Forest Service's Pacific Southwest Regional Forester's office has identified forty land bird species that are of particular concern and are a high priority for monitoring efforts in the Sierra Nevada bioregion (USDA Forest Service 1996):

Acorn woodpecker	Golden eagle (MIS)	Red-breasted sapsucker (MIS)
Band-tailed pigeon (MIS)	Great gray owl (FSS)	Rufous-crowned sparrow
Belted kingfisher	Lawrence's goldfinch	Sage grouse
Black swift	Lazuli bunting	Sage sparrow
Black-backed woodpecker	Lewis' woodpecker	Sharp-shinned hawk (MIS)
Black-chinned sparrow	Long-eared owl	Swainson's thrush
Blue grouse (MIS)	Northern goshawk (FSS)	Vaux's swift
Blue-gray gnatcatcher	Northern saw-whet owl	Western wood-pewee
California thrasher	Olive-sided flycatcher	White-crowned sparrow (MIS)
Chipping sparrow	Osprey (MIS)	White-throated swift
Common nighthawk	Phainopepla	Willow flycatcher (FSS)
Cooper's hawk	Pine grosbeak	Yellow-billed cuckoo (FSS)
Evening grosbeak	Prairie falcon (MIS)	
Flammulated owl	Purple martin	

Note: FSS indicates a Forest Service sensitive species, and MIS indicates a Forest Service management indicator species (on at least one national forest).

A draft avian conservation plan for the Sierra Nevada bioregion (Siegel and DeSante 1999) outlines four priority habitats for conservation: montane meadows, non-meadow riparian habitat, late successional/old growth forest, and oak woodlands. The draft plan also outlines conservation recommendations for each of the priority habitats as well as range-wide recommendations. In addition, other conservation plans are applicable to the SNFPA planning area: Riparian Bird Conservation Plan (Riparian Habitat Joint Venture 2000); Oak Woodland Conservation Plan (California Partners in Flight 2002b); and draft Coniferous Forest Bird Conservation Plan (California Partners in Flight 2002a). Each of these plans contains a discussion of habitats, focal species, and conservation recommendations, several of which are applicable to management of habitats in the Sierra Nevada.

The risk factors to all bird species cannot be described generally, as different species utilize different nesting, and foraging habitats and response to human activity is variable. Moreover, the overall effect of management activities on populations of neotropical migratory bird species have generally not been studied, unless a species is classified as threatened, endangered, Forest Service sensitive, or, to a limited extent, MIS. In general, viability of species dependent upon National Forest System lands or significantly affected by management of National Forest System lands is considered in determining if a species should be managed as a Forest Service sensitive species. Current management guidelines for the Sierra Nevada bioregion are designed to provide for a diversity of habitats and they focus on the same four priority habitats identified in the avian conservation plan for the Sierra Nevada bioregion. Management direction is not specific to individual bird species, except for those designated as threatened, endangered, or sensitive, and management is generally focused on habitats and overall population trends rather than individuals.

3.2.5. Endangered, Threatened, Proposed, and Sensitive Plant Species

The SNFPA FEIS (chapter 3, part 4.6, pages 5 -75) conducted vulnerability assessments on 135 threatened, endangered, proposed-for listing, and sensitive plant species. Two field seasons have elapsed since the signing of the ROD. Information on all but ten plant species remains as it was identified in the FEIS. New information on these plant species is provided below.

Keck's checker mallow (*Sidalcea keckii*) was listed as endangered by the FWS in 2000 (65 FR 7757-7764) and designated critical habitat has been proposed (68 FR 12863-12879) since the signing of the

ROD. At this time, no populations or critical habitat are known to occur on Forest Service lands. However, known populations are known to occur adjacent to the Sequoia and Sierra National Forests.

Slender orcutt grass (*Orcuttia tenuis*) and Green's tuctoria (*Tuctoria greenei*) have had critical habitat designated (68 FR 46684-46867) since the signing of the ROD. Critical habitat for both species occurs on the Lassen National Forest.

Ramshaw Meadows sand-verbena (*Abronia alpina*) is endemic to Ramshaw and Templeton Meadows on the Inyo National Forest. In the FEIS, it was determined that livestock grazing posed a threat to this species. Livestock grazing in Ramshaw and Templeton Meadows does not currently pose a threat because this allotment is now vacant. Future decisions to allow livestock grazing will consider effects to this species and may require updating the Conservation Agreement with the U.S. Fish and Wildlife Service.

Kern Plateau milk-vetch (*Astagalus lentiginosus* var. *kernensis*) is found on the Kern Plateau in Tulare County from Bald Mountain north to Volcano Creek. One occurrence is known from Charleston Peak in Nevada. Information in the FEIS stated that "this plant is known from less than 20 occurrences." The primary threats to this species are believed to be livestock trampling, roads, and motorized and non-motorized recreational use. Since the signing of the ROD, additional field surveys have detected new individuals or populations. More than 30 occurrences are now known.

Mono milk-vetch (*Astragalus monoensis* var. *monoensis*) is an endemic of Mono County. The FEIS reported 19 occurrences having more than 100,000 individuals. Threats included livestock grazing and trampling, road construction and maintenance, and timber harvest. More recent information shows that off-highway vehicle use is the primary threat.

Short-leaved hulsea (*Hulsea brevifolia*) is known to occur on the Sierra, Sequoia, and Inyo National Forests and in Yosemite National Park. The information in the FEIS stated that "this plant is known from less than 25 occurrences." Continued survey efforts since the signing of the ROD have now found additional occurrences. More than 35 occurrences are know known. No new threats beyond those identified in the FEIS have been identified.

Veined water lichen (scientific name changed from *Hydothyria venosa* to *Peltigera hydrothyria*) is found in cold unpolluted streams in mixed conifer forest along the western slope of the Sierra Nevada on the Sequoia, Sierra, and Stanislaus National Forests. The FEIS stated that "this aquatic lichen is known from less than 20 occurrences in California." Continued survey effort now shows this species occurs in at least 27 locations in the Sierra Nevada.

Mono County phacelia (*Phacelia monoensis*) is known to occur in Mono County of California and Esmeralda and Mineral Counties of Nevada. Information in the FEIS states that "population size varies from year to year for this annual plant. There are less than 40 occurrences." Since the signing of the ROD, monitoring of this species now shows that there are fewer than 20 occurrences. Because the population tends to vary in size from year to year, the trend for this species is unknown. The primary threats are invasive weed infestation, mining, and road maintenance.

Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) was not thought to be present on Forest Service land at the time the ROD was signed and was therefore dismissed from further analysis. It was since been discovered on the Sequoia National Forest. This species is found in the San Joaquin Valley and Sierra Nevada foothills below 2000 feet in blue oak woodland, riparian woodland, and sparse open semi-desert. One population of has been confirmed at the Lower Richbar picnic ground on the Lower Kern River.

3.3. Land and Resource Uses

3.3.1. Commercial Forest Products

This section updates and supplements the information found in FEIS volume 2, chapter 3, part 5.1, pages 369-377, and part 5.9, pages 519-533.

Sawtimber Production

Timber sale offerings from the national forests in the Sierra Nevada have been steadily decreasing since the late 1980's (table 3.3.1a). For fiscal years 1991 to 1993, the annual average timber sale offerings from national forests in the Sierra Nevada were 743.103 million board feet (MMBF) of green and salvage timber. These numbers dropped steadily over the next nine years. For fiscal years 1994 to 1996, an annual average of 429.730 MMBF green and salvage timber was offered by Sierra Nevada national forests. For the period from fiscal year 2000 to 2002, the annual average of green and salvage timber had plummeted to 214.803 MMBF. These figures represent a 71% reduction of green and salvage timber offerings from the annual averages of 1991 to 1993 to the annual averages of 2000 to 2002. Likewise, the average annual sales of sawtimber sold from national forests in the Sierra Nevada dropped from 997.5 MMBF during 1988-1990 to 118.8 MMBF from 2000 to 2002, a decrease of nearly 90% over the fifteen years (table 3.3.1b).

Table 3.3.1a. Timber Sale Offerings from Sierra Nevada National Forests for Fiscal Years 1991-2002.

National Forest	Annual Average FY 1991-1993		Annual Average FY 1994-1996		Annual Average FY 1997-1999		Annual Average FY 2000-2002	
	Green (MMBF)	Salvage (MMBF)	Green (MMBF)	Salvage (MMBF)	Green (MMBF)	Salvage (MMBF)	Green (MMBF)	Salvage (MMBF)
Eldorado	70.928	110.631	11.916	18.577	21.397	29.401	30.196	12.908
Inyo	9.983	0.000	4.955	0.409	3.354	1.334	1.883	1.335
Lassen	58.569	44.337	36.417	68.852	33.900	24.770	48.134	17.046
Modoc	24.302	9.131	5.147	39.911	5.483	10.282	8.731	0.0
Plumas	58.504	59.332	24.518	29.946	20.031	20.594	10.021	5.793
Sequoia	16.159	45.466	12.003	7.236	17.200	3.934	4.959	2.876
Sierra	33.657	46.014	16.201	21.499	13.830	11.637	4.083	5.693
Stanislaus	21.312	71.459	31.481	6.025	9.953	27.420	8.319	6.767
Tahoe	35.455	15.837	23.637	54.620	19.529	34.137	22.325	22.127
LTBMU	5.708	6.318	0.569	15.811	2.264	3.300	1.198	0.407
Total	**334.577**	**408.526**	**166.844**	**262.886**	**146.941**	**166.810**	**139.849**	**74.954**
Total, green and salvage		**743.103**		**429.730**		**313.751**		**214.803**

Notes: Does not include the Humboldt-Toiyabe National Forest. MMBF = million board feet. (Source: USDA Forest Service Pacific Southwest Region 2003f)

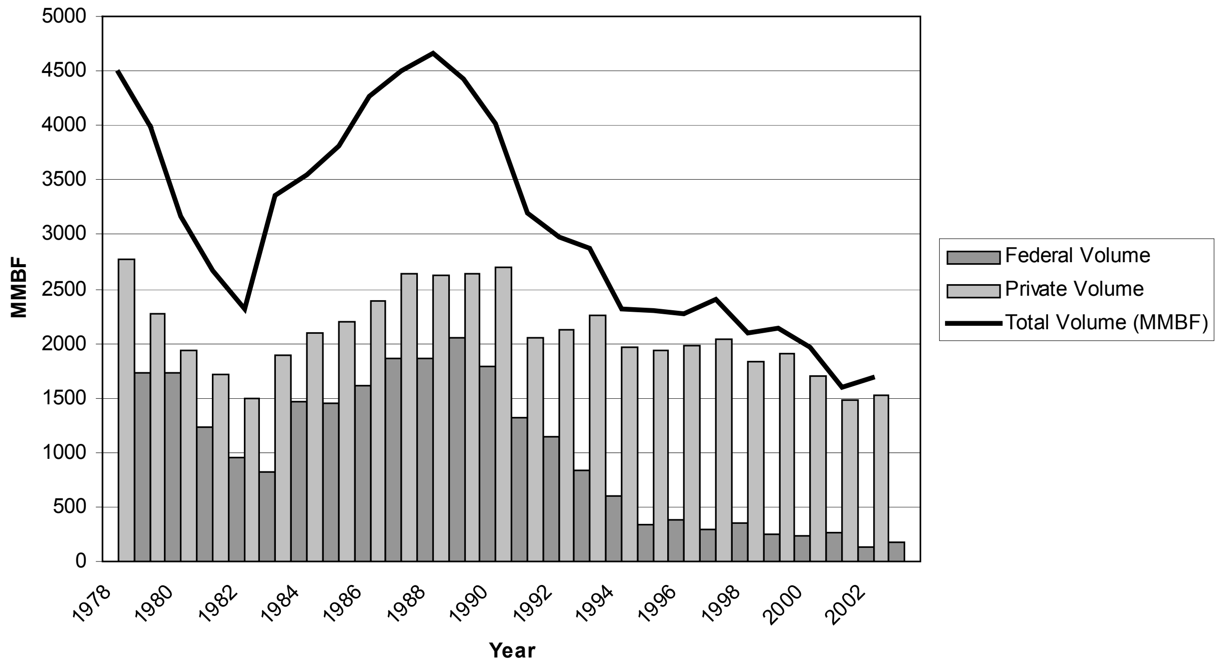
Table 3.3.1b. Average Annual Sawtimber Sold from National Forests in the Sierra Nevada Region, Calendar Years 1988-2002.

National Forest	Average Annual Sales (MMBF)				
	1988-1990	**1991-1993**	**1994-1996**	**1997-1999**	**2000-2002**
Eldorado	156.4	109.5	5.9	40.6	35.2
Inyo	5.1	5.2	0.3	1.1	3.4
Lassen	134.9	124.2	19.3	41.7	19.8
Modoc	51.9	31.6	5.2	9.2	4.6
Plumas	185.3	75.6	20.0	23.3	6.0
Sequoia	48.5	47.7	4.9	14.1	6.1
Sierra	122.6	51.8	19.4	10.9	7.9
Stanislaus	180.1	47.4	14.2	31.7	10.2
Tahoe	103.3	33.3	47.3	31.1	25.1
LTBMU	4.0	3.6	13.8	1.4	0.4
Humboldt-Toiyabe	5.4	3.2	3.3	0.0	-
TOTAL	**997.5**	**533.0**	**153.7**	**205.1**	**118.8**

MMBF = million board feet (Source: USDA Forest Service 1998-2002)

Timber harvest from all federal lands in California now accounts for 10% of the statewide total harvest volume (figure 3.3.1a). In 1990, the federal share was 33%. Volume harvested from private lands has declined from 2,695 million board feet in 1990 to 1,521 million board feet in 2002 (State of California Board of Equalization 2003). Since 1990, 89 wood product manufacturing facilities in California have closed. During August 2003, another company announced that it will be closing, increasing the number to 90. Multiple factors are involved in closures, including the supply of and demand for both raw materials and finished products. Consolidation and increasing efficiency in the forest products industry has also played a role (Laaksonen-Craig et al. undated).

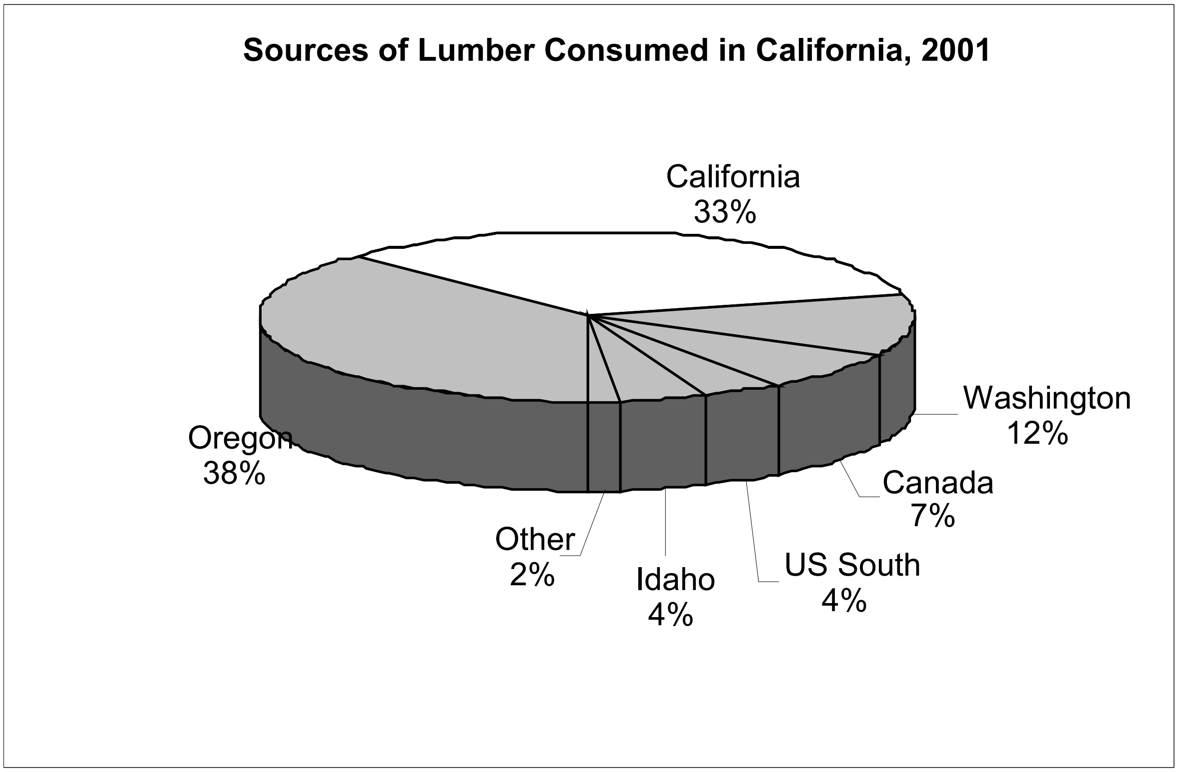
Figure 3.3.1a. California Timber Harvest Statistics



(Source: California State Board of Equalization 2003)

California's customs ports do not provide for a precise calculation of imported wood products. According to the 2003 Fire and Range Assessment Program's Assessment, California imports a minimum of 66% of its demand for lumber products (California Department of Forestry and Fire Protection 2003). Figure 3.3.1b illustrates the source for lumber used in California. Lumber consumption for 1999 was estimated to be almost 9 billion board feet, suggesting that about 6 billion board feet was imported. Imports of other forest products such as particle board, oriented-strand board, paper, and paperboard, are estimated to be even higher (Laaksonen-Craig et al. undated).

Figure 3.3.1b. Sources of Lumber Consumed by California Markets.



(Source: California Department of Forestry and Fire Protection 2003)

Commercial Biomass

Table 3.3.1c shows the amount of woody biomass (convertible wood products and excelsior) sold from Sierra Nevada national forests. The Lassen and Plumas National Forests have historically been the largest producers of chips produced at harvest sites. Besides these national forests, only the Modoc and Stanislaus National Forests have been significant producers of commercial biomass, because production is largely dependent on proximity to industrial operations using biomass (e.g. powerplants). The Inyo, Humboldt-Toiyabe, Sequoia, and Sierra National Forests have produced small amounts of merchantable biomass. Low production in the southern and eastside Sierra Nevada subregions, and the highly variable yearly output by forest and in the bioregion, is indicative of the nature of the biomass market. The demand for biomass has changed rapidly. The result is that national forests and private industry are both reluctant to invest significant time and energy in biomass production compared to other activities. In turn, however, this reluctance inhibits the establishment of forest biomass cogeneration facilities, because supplies are inconsistent. Biomass utilization would likely improve under circumstances where the delivery of raw material is stable.

Table 3.3.1c. Commercial Biomass Produced from Sierra Nevada National Forests, Calendar Years 1990-2002.

National Forest	Biomass Production (Bone Dry Tons)												
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Eldorado	-	-	3,225	393	-	-	15	2,205	8,500	-	1,276	5,799	-
Inyo	-	-	-	25	-	-	-	-	-	-	-	-	-
Lassen	34,248	10,543	1,010,404	177,366	2,321	131,549	34,064	111,123	74,597	73,765	46,965	84,539	70,674
Modoc	2,645	495	6	2,959	73,906	68,109	17,105	35,756	14,664	2,500	1,000	29,272	8,297
Plumas	18,485	8,680	76,628	13,632	22,586	30,144	34,724	40,956	50,027	26,682	19,387	11,846	11,948
Sequoia	-	-	-	1,188	-	-	-	-	-	-	-	-	-
Sierra	3	6	8	2,625	-	7,771	775	2,538	406	-	2,365	-	96
Stanislaus	9,665	13,043	26,030	7,939	1,615	17,742	16,028	12,635	1,320	4,818	3,413	3,071	6,873
Tahoe	-	55	9,582	35,851	-	55,748	80,413	23,242	3,703	17,324	11,778	10,503	9,606
LTBMU	-	-	-	-	6,875		-	3		38	1	1,084	488
Humboldt-Toiyabe	-	-	-	-	-	-		-		-	-	-	-
TOTAL	**65,046**	**32,822**	**1,125,883**	**241,978**	**107,303**	**311,063**	**183,124**	**228,458**	**153,217**	**125,127**	**86,185**	**146,114**	**107,982**

Note: converted from mbf to bone dry ton (bdts) (2.5bdt/mbf) (Source: USDA Forest Service Pacific Southwest Region 1990-2002)

3.3.2. Grazing

The following information replaces information provided in the SNFPA FEIS volume 2, chapter 3, part 5.3, page 402, under "Grazing Use Levels."

Over the past 15 to 20 years, livestock grazing has declined by over 50% in the Sierra Nevada national forests. Approximately 163,000 head of cattle and sheep grazed in the early 1980's. By 2002, this number had dropped to 74,000 head. Many factors have contributed to this decline, including the implementation of land management standards and guidelines in forest plans, management for threatened and endangered species, management to meet water quality standards, livestock market fluctuations, and changing lifestyle choices by ranching families.

3.4 Social and Economic Environment

Introduction

The Sierra Nevada Forest Plan FEIS has a section on 'Society, Culture, and Economy' in the Affected Environment and Environmental Consequences (SNFPA). There is additional information in the appendices of the SNFPA DEIS document, see Appendix N – Population and Demographics, and Appendix O – Employment (SNFPA DEIS). Information is provided for a variety of economic and social factors such as population and growth trends, ethnicity, age distribution, income, the labor force and employment.

The Sierra Nevada region is wealthy and well diversified. A publication from the Sierra Business Council titled "Sierra Nevada Wealth Index" (1998) makes the following statements:

- Rapid improvements in communications and transportation have brought Sierra businesses ever closer to their customers worldwide.
- A new breed of economic pioneer is moving to the Sierra – skills and capital in hand - inspired by the opportunity to live and raise families in small communities with easy access to the natural splendors of the Sierra Nevada.
- At the same time, skilled young people and business owners, who might have once been forced to leave the region to find work or expand their operations, are finding they can remain in the Sierra and prosper.
- Polls of Sierra Nevada voters and interviews with Sierra Nevada business owners demonstrate that the primary motivation for most people to live in the Sierra Nevada is the region's outstanding quality of life and exceptional natural environment.
- The 1999-2000 Sierra Nevada Wealth Index shows rising economic diversity, rising personal incomes, declining unemployment, and new heights of scholastic achievement.
- This increasing prosperity and population increases have resulted in loss of farmland, water and air pollution, declining biodiversity and unsightly sprawl.
- There are some counties with growing number of children in poverty, declining personal incomes, low literacy rates, and outdated communications infrastructure. There is a need to invest in social capital so as to build regional wealth.
- Fire hazard is significant on 45% of the Sierra Nevada landscape.
- Very little old-growth forest habitat remains.

Population and Ethnicity Trends

The Sierra Nevada Region counties contain an estimated 3.8 million people or about 10.8 percent of the combined California and Nevada population of 35 million people (USDA Forest Service Pacific Southwest Region. 2001a). Population growth is expected continue at a rapid pace. Between 1989 and 1999 populations in 13 counties in the region grew faster than the California statewide average. Both Madera and Placer counties had population increases of 40 percent for the period. Only Sierra County had a net decline in population. Areas of slow population growth (less than 5 percent) were Plumas, Esmeralda, Inyo, and Mineral Counties.

Tables N2, N4 and N6 in Appendix N in the SNFPA-DEIS show the total population projections by ethnic groups from 1998 to 2010 and to 2040. Respectively, these tables show total regional population projections going from 3.3 to 4.3 and then 6.8 million people, more than doubling of the population in 42 years. A significant increase in the percent of people with Hispanic ethnic background is projected, going from a regional average of 26, to 30, and then to 42 percent of total population 1998, 2010 and 2040 (see Tables N3, N5 and N7 in SNFPA-DEIS). The major percentage decline of total population in this period is from the White, not Hispanic ethnic group, going from 64 to 60 to 46 percent in 1998, 2010, and 2040.

Projections for 2010 indicate that the absolute numbers of elderly people will rise, but the proportion of elderly people will drop in most counties and remain constant or drop in all subregions. At the same time the share of the population less than 17 years old is expected to drop. By 2040, the share of population less than 17 years old will have climbed once again. By this time the 18 counties in the Region will have populations with greater than 18 percent of the people older than 65 years. Elderly people will be more evenly distributed among the Sierra Nevada Region counties. In the foreseeable future, the Sierra Nevada population will not be "graying."

Employment Trends

The State of California has a large and diverse economy. In 1995 there were over 17 million jobs statewide. The resource extractive industries (mining, oil and gas, and lumber and wood products) accounted for about 1 percent of total personal income in 1970 and 1995. From 1970 to 1995 the State of California added almost 8 million new jobs. The fastest growing sectors, in terms of job creation, were Services (47% of new jobs), Retail Trade (17% of new jobs), Finance, Insurance and Real Estate (8% of new jobs), and Government (7% of new jobs). The largest sectors in 1995 were Services (33%), Retail Trade (16%), Government (14%), and Manufacturing (11%) (Alexander and Rasker 1998)

Appendix O, Table O.3 in the DEIS (SNFPA-DEIS) provides details about job projections for jobs in the Sierra Nevada forests and for forest product related jobs in Sierra Nevada communities. This follows the state-wide trend in that the Service Sector (dining, lodging, amusement related, and recreation) shows the largest increases. There is modest increase in the number of fire fighter jobs. Jobs for biological scientists, including foresters and forest ecologists are forecast to remain constant. Logging and forest conservation jobs may increase slightly in some counties; however the total number of jobs of these types of jobs in the Sierra Nevada Region is expected to decline. The number of carpentry jobs and precision woodworking jobs is also expected to increase.

Chapter 4: Environmental Consequences

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Chapter 4: Environmental Consequences

Introduction

This chapter presents the environmental consequences for the alternatives analyzed in this supplemental environmental impact statement (SEIS) for the Sierra Nevada Forest Plan Amendment (SNFPA). Information in this chapter addresses aspects of the environment likely to be affected by the management actions proposed in the alternatives. This chapter describes the environmental effects of the alternatives and the scientific and analytical basis for the conclusions reached.

The environmental consequences sections in the January 2001 final environmental impact statement (FEIS) for the SNFPA were reviewed to assess whether new information and/or proposed management changes would be likely to change the effects analyses previously conducted. The rationale for excluding certain subject areas from further analysis is documented in Appendix C "Consistency Review of Documentation for the Sierra Nevada Forest Plan Amendment."

Parts 4.2 through 4.5 of this chapter focus on the environmental consequences associated with Alternatives S1 and S2. Part 4.6 briefly describes the environmental consequences for Alternatives and F2 through F8. Detailed analyses of environmental consequences for Alternatives F2 through F8 are presented in the SNFPA FEIS, Volumes 2 and 3. The information presented in this document for these alternatives (F2 through F8) addresses aspects of environmental consequences that have changed based on new information identified during the SNFPA review process.

Science Consistency Review

The Regional Forester convened a team of scientists with expertise in fire and fuels management, forest ecology, and species viability to evaluate the science consistency of the DSEIS.

The review team scrutinized the DSEIS using the following criteria (Guldin and others, in press):

- Has applicable and available scientific information been considered?
- Is the scientific information interpreted reasonably and accurately?
- Are the uncertainties associated with the scientific information acknowledged and documented?
- Have the relevant management consequences, including risks and uncertainties, been identified and documented?

Initially, the review team concentrated on four primary areas; fire and fuels management; forest ecosystem management; species viability; and synthesis issues. After further discussion and deliberation the Regional Forester requested supplemental science consistency review of additional questions regarding species viability, fire and fuels management and California Spotted Owl viability. The supplement reviews considered stand structure needs of CASPO; landscape level considerations desired to sustain owl habitat, desired future conditions for Protected Activity Centers (PACs); general owl biology; risk and uncertainty; and viability of Pacific fisher, willow flycatcher and Yosemite toad.

Overall, review team members judged the DSEIS to be generally consistent with available scientific information. There are some exceptions related to 1) completeness and documentation of bibliographic citations in the DSEIS, 2) sufficient detail in the discussion of monitoring plans, and 3) concern that the overall DSEIS in general, and the section that presented the standards and guidelines in particular, was sufficiently confusing so as to not allow a reviewer to clearly understand their intent.

Significant improvements were made in the FSEIS based on the SCR report and discussions with the Consistency Review Team. The review team's findings and the Forest Service's response are summarized in this appendix.

The ID team used the comments of the Consistency Review Team, along with comments from other agencies, outside scientists and the public to improve the FSEIS. From draft to final, the IDT team improved readability and clarity of the document; clarified management direction, used more graphics and tables to clearly display complex information; improved consideration, interpretation and citation of scientific information; enhanced discussion of risk and uncertainty; and acknowledged and addressed responsible opposing scientific viewpoints. Issues of scientific controversy, conflicting scientific information, uncertainty and significant data gaps are summarized in Appendix E, Science Consistency Review and in SEIS Volume 2, Response to Comments.

The input received from these processes generated improvements in the FEIS and described above. The public comment also contained input from some scientists who were not part of the official science consistency report. That input did not restrict itself to or necessarily use the review criteria used during the science consistency review. Some offered additional citations that were reviewed and noted. Differing opinions on appropriate management strategies, in light of scientific uncertainty, were also suggested.

4.1. Cumulative Effects

4.1.1. Background

Cumulative effects are those impacts on the environment that result from the incremental effects of an action when it is added to other past, present, and reasonably foreseeable future actions, regardless of the responsible agency or party (40 Code of Federal Regulations [CFR] part 1508.7). The FEIS provided a detailed assessment of potential cumulative effects of the eight alternatives for managing the national forests in the Sierra Nevada. The assessment included discussions of cumulative effects in the context of

- other plans, policies, and initiatives;
- the five problem areas addressed by the SNFPA; and
- specific management programs.

A summary of the assessment is provided below. Most of FEIS assessment adequately describes the cumulative effects of implementing the proposed changes considered in this draft SEIS. Where that is not the case, supplemental information is provided here to update the assessment in the FEIS.

The cumulative effects analysis for this SEIS includes actions completed in the Sierra Nevada national forests since the SNFPA Record of Decision (ROD) was issued (January 2001). For example, based on Forest Service Region 5 management attainment reports and performance accomplishment reports, management activities in 2001, 2002, and 2003 include:

- 6,200 acres of noxious weed treatments (average of 2,067 acres per year),
- 4,500 acres of soil and water resource improvements (average of 1,500 acres per year),
- 154,800 acres of hazardous fuels reduction (average of 51,600 acres per year), and
- more than 225,000 acres of wildfire suppression (fires larger than 10 acres in size).

During the years of 2001, 2002, and 2003, a total of 19 miles of new system road were constructed; 210 miles of road were reconstructed. Also during 2001 and 2002, about 225,000 acres were burned by wildfires larger than 10-acres in size (again, the 2003 data was not available; the average of the two prior years was used).

The ROD projected that more than 90,000 acres of land would be treated annually to reduce hazardous fuels across the Sierra Nevada. Accomplishments in the first 3 years of implementing the ROD averaged less than 52,000 acres (58% of that projected). During the 10-year period preceding the ROD, wildfires burned an average of 63,000 acres per year. In the first 2 years of implementing the ROD, wildfire averaged 112,500 acres per year. In conclusion, the actions taken and the acres affected since the ROD was issued fall within the range of activities analyzed in the cumulative effects analysis disclosed in the FEIS. The cumulative effects discussion in this SEIS includes actions and effects reported for the post-ROD period.

4.1.2. Cumulative Effects of Other Plans, Policies, and Initiatives

The assessment in the FEIS related the alternatives under consideration to other federal, state, and local policies, plans, and initiatives that affect the Sierra Nevada (FEIS, volume 2, part 1.3, pages 3-16). The assessment concluded that all of the alternatives were consistent with other Forest Service policies, plans, and initiatives. The alternatives were also consistent with all applicable state regulations. While no conflicts with other policies, plans, or initiatives were identified, the FEIS recognized that conflicts were possible at the local level. The FEIS noted that all agencies routinely seek review from other governmental agencies during development of work under their authority. The purpose is to avoid conflicts in policies, plans, and initiatives at all levels.

The assessment in the FEIS adequately describes the relationships of national forest management to other plans, programs, and initiatives for the Sierra Nevada. Generally, the relationships do not vary by alternative, have not changed since the FEIS was completed, and most are not sensitive to the changes being proposed in this SEIS. However, some programs have changed since the FEIS was issued in ways that could make them sensitive to the changes being proposed in the SEIS. Moreover, some new programs have emerged. New information for these efforts is provided below.

Revisions to the National Forest Management Act Regulations

On November 9, 2000, the Secretary of Agriculture (Secretary) adopted a final rule substantially revising land and resource management planning regulations for National Forest System lands at 36 CFR part 219 (65 Federal Register [FR] 67514). Section 219.35 of that rule provided for a transition from the 1982 planning rule to the 2000 rule. Under the requirements of section 219.35, as adopted, all amendments and revisions to land and resource management plans must be prepared pursuant to the November 2000 planning rule, unless the amendment or revision was initiated before November 9, 2000, and a notice of availability of the required environmental disclosure document was published before May 9, 2001. T

The Secretary subsequently determined that the Forest Service was not sufficiently prepared to implement the November 2000 planning rule. On May 17, 2001, the Secretary issued an interim final rule immediately extending the compliance date of May 9, 2001, to May 9, 2002, in anticipation that a revised planning rule would be in place by that date (66 FR 27552). A subsequent FR notice on May 20, 2002, modified the transition language to extend the compliance date to whenever the Secretary of Agriculture promulgates revised planning regulations (FR 02-12508). A set of draft planning regulations was published in the FR on December 6, 2002. The public comment period was extended and closed on April 7, 2003. Final planning regulations are pending.

The Notice of Intent to prepare an environmental impact statement to amend the forest plans of the Sierra Nevada national forest was published in the FR on November 20, 1998, well in advance of the May 9, 2001, deadline explained above. The SNFPA FEIS and this SEIS were prepared using many of the same key elements in the 2000 planning regulations and the draft 2003 planning regulations. They were developed in a collaborative manner, included emphasis on ecological, social, and economic sustainability; are science based; and stress an adaptive management approach. The project began well before the 2000 planning regulations were released. However, given the Secretary's concerns over the ability of the national forests to use the 2000 regulations and the ongoing uncertainty regarding final direction in the new regulations, the regional forester of Region 5 decided that the SNFPA would comply with the requirements of the 1982 rule. The decisions resulting from the SFEIS will be subject to administrative appeals under the provisions of 36 CFR 217.

U.S. Fish and Wildlife Service Decision on the California Spotted Owl

On April 3, 2000, the USDI Fish and Wildlife Service (FWS) received a petition from the Center for Biological Diversity, the Sierra Nevada Forest Protection Campaign, and other organizations to list the California spotted owl (*Strix occidentalis occidentalis*) as a threatened or endangered species under the federal Endangered Species Act (ESA) of 1973. On October 12, 2000, FWS determined that listing the California spotted owl may be warranted and requested information and data regarding the species. However, on February 7, 2003, FWS determined that listing of the California spotted owl was not warranted under the ESA.

FWS concluded that results of a demographic analysis are not conclusive with respect to the population status of the California spotted owl: "There is no definite evidence that the population is decreasing across its range, and various analytical results of the individual study areas are not wholly supportive of conclusions regarding declines in any given study area." (FR, volume 68, number 31, page 7595) Furthermore, FWS declared that "Substantial scientific uncertainty remains regarding the effects of fuel treatments in PACs [*protected activity centers*] and foraging areas. However, in absence of demonstrated effects, and considering the potential negative impacts are also accompanied by positive effects from fire risk reduction and faster development of high quality habitat, we [FWS] find that the timber harvest and fuel treatments proposed under the SNFPA do not constitute a significant threat to the California spotted owl at this time" (page 7601). Because changes in management direction established by the SNFPA SEIS could affect California spotted owls, the FWS stated an intention to monitor the situation and review the status of this species at a later date, if necessary.

National Fire Plan

In August 2001, the Secretaries of Agriculture and the Interior joined the Western Governors' Association, National Association of State Foresters, National Association of Counties, and the Intertribal Timber Council to endorse *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-Year Comprehensive Strategy*. The Secretaries of the Interior and Agriculture and the governors jointly develop a long-term national strategy to address wildland fire, the hazardous fuels situation, and the needs for habitat restoration and rehabilitation. The strategy is being developed through close collaboration among citizens and governments at all levels. This initiative has been commonly called the *National Fire Plan* by the Departments of Agriculture and Interior. The implementation plan for the National Fire Plan does not alter, diminish, or expand existing jurisdictions, statutory and regulatory responsibilities and authorities, or budget processes of participating federal, state, and tribal agencies.

The goals for the National Fire Plan are to improve fire prevention and suppression, reduce hazardous fuels, restore fire-adapted ecosystems, and promote community assistance. Its three guiding principles are:

- priority-setting that emphasizes the protection of communities and other high-priority watersheds at risk,
- collaboration among governments and broadly representative stakeholders, and

- accountability through performance measures and monitoring of results.

In California, federal agencies joined with state and local fire protection providers to form the *California Fire Alliance*. The overall mission of the alliance is to merge California's fire plan with the National Fire Plan in ways that provide to the public effective and efficient fire protection statewide.

In the Sierra Nevada, cooperative implementation of the California's fire plan and National Fire Plan is now underway. Increasingly, state, federal, and local agencies are working with community groups to develop local fire protection plans that identify high priority projects extending across multiple ownerships. The agencies are then using the aggregate of their available funds to complete projects.

All cooperating agencies are bringing their planning processes to this new cooperative fire planning venture. The combined processes are being used to produce projects that conform to the regulations, guidelines, and other directives of each agency. According to the proposed changes in this SEIS, the Forest Service would also provide fire protection programs that improve conditions within the region, complimenting the work of other fire protection agencies.

The President's Healthy Forests Initiative

In 2002, President Bush directed the Secretaries of Agriculture and Interior and the Chairman of the Council on Environmental Quality (CEQ) to improve regulatory processes to ensure more timely decisions, greater efficiency, and better results in restoring forest health to reduce the risk of catastrophic wildfires. The Healthy Forests Initiative includes

- improving procedures for developing and implementing fuels treatment and forest restoration projects in priority forests and rangelands, in collaboration with local governments;
- reducing the number of overlapping environmental reviews by combining project analyses and establishing a process for concurrent project clearance by Federal agencies;.
- developing guidance for weighing the short-term risks against the long-term benefits of fuels treatment and restoration projects; and
- developing guidance to ensure consistent procedures under the National Environmental Policy Act (NEPA) for fuels treatment activities and restoration activities, including development of a model environmental assessment for these types of projects.

To achieve these goals, Interior Secretary Norton, Agriculture Secretary Veneman, and CEQ chairman Connaughton met with President Bush in December 2002. Together, they identified several steps that would guide forest health activities and ensure more timely decisions. These steps are described in the following sections.

Initiate More Fuels Treatment and Restoration Projects

On June 5, 2003, the Departments of Agriculture and the Interior published new procedures that will enable priority hazardous fuels reduction treatments and post-fire rehabilitation activities to proceed quickly. Fuels treatment projects under these procedures must be identified by federal agencies working in collaboration with state, local, and tribal governments and interested persons. The departments reviewed the effects of over 2,500 hazardous fuel reduction and rehabilitation projects and concluded that these projects constitute a category of actions that does not individually or cumulatively have a significant effect on the human environment. These projects are expected to be the primary means of implementing any of the alternatives considered in this SEIS and will help restore forest and rangeland ecosystems, benefiting many species and their habitat.

Amend Rules for Project Appeals to Hasten Process

On June 4, 2003, the Department of Agriculture revised the notice, comment, and appeal procedures (36 CFR 215) for projects and activities implementing land and result management plans for the national forests. The revised procedures clarify and reduce the complexity of the appeals process, improve the efficiency of processing appeals, encourage early and effective public participation in project-level environmental analysis, and ensure consistency with the provisions of the statutory authority.

Improve ESA Process to Expedite Decisions

The Departments of Interior and Commerce have jointly released two guidance documents to their staffs that change the process for reviewing fuels treatment projects under the ESA. The first document encourages the use of several streamlining techniques to expedite the consultation process, such as carrying out integrated regional planning for fuels treatment projects. The second document clarifies that ESA evaluations should consider the long-term environmental benefits of fuels treatment projects, as well as the potential for adverse effects, and that projects with net benefits should be expedited. Both documents are intended to facilitate timely completion of fuels treatment projects, while providing protection for wildlife and restoring habitat.

Improve and Clarify Process of Environmental Assessment

CEQ will issue guidance to the Departments of Interior and Agriculture establishing an improved and focused process for conducting environmental assessments under NEPA for healthy forest projects. These departments will send senior advisors to work with their field offices to immediately implement the new process. The two agencies will undertake at least 10 pilot projects to establish the effectiveness of these expedited procedures. Two of the ten pilot projects will be located in California and one (Eldorado National Forest) will be located in the Sierra Nevada.

Healthy Forests Restoration Act of 2003

On December 3, 2003, HR 1904, the Healthy Forests Restoration Act of 2003 was signed into law. The legislation provides new tools and additional authorities to treat more acres more quickly. The Act is intended to help expedite projects aimed at restoring forest and rangeland health by providing streamlined administrative decisions and provide courts direction when reviewing fuel reduction or forest health projects.

- The legislation generally:
  1. Strengthens public participation in developing high priority forest health projects.
  2. Reduces the complexity of environmental analysis.
  3. Provides a more effective appeals process that encourages up-front public participation in project planning.
  4. Instructs the courts to balance the short and long term effects of projects before issuing injunctions (balance of harms) and limits the length of court injunctions while urging expedited review of lawsuits filed against forest health projects.
- Specifically the legislation:
  5. Allows hazardous fuel reduction through various methods including thinning and prescribed fire on up to 20 million acres of Federal land.

6. States that any activity within old-growth stands must fully maintain or contribute toward maintaining the integrity of old growth stands according to forest type.

7. Focuses tree removal activities outside old-growth acres on small diameter trees and leaving larger trees, as appropriate, for the forest type to promote fire resistant forests.

8. Instructs the Secretaries to develop project priorities considering recommendations from community wildfire protection plans, and directs overall that not less than 50% of the funds allocated for projects be used in the wildland urban interface.

9. Addresses the need for an early warning system for potential threats to forests from insects, disease, fire and weather related risks to increase the likelihood of successful prevention and treatment.

4.1.3. Cumulative Effects for the Five Problems addressed in the FEIS

The FEIS evaluated the cumulative effects of the SNFPA alternatives on selected resource problem areas in the Sierra Nevada (volume 2, part 1.3, pages 16-25). Because the changes proposed are consistent with the range of choices in the FEIS, this assessment adequately describes the conditions that would result from implementing the alternatives in this SEIS. A summary of the key findings is presented below.

Old Forests

The assessment concluded that, under all alternatives, the national forests and national parks will continue to be the primary contributors of old forest conditions in the Sierra Nevada. Most of the old forests will be on the national forests, and the amount of old forests will increase under all alternatives.

Aquatic, Riparian, and Meadow Habitats

The combined work across ownerships will lead to improved aquatic, riparian, and aquatic habitat conditions in the future. The strategies for managing these resources under all of the alternatives would contribute to this condition.

Forest Fuels and Fire Protection

All of the alternatives to various degree would contribute to an overall improving trend in fuels reduction and fire protection in the region.

Invasive Plants

The Forest Service will provide programs for reducing the spread of noxious weeds under all alternatives. When combined with the programs of other agencies and landowners, the Forest Service program will lead to better control of noxious weeds in the Sierra Nevada over time.

4.1.4. Cumulative Effects on Specific Management Programs

The SNFPA FEIS disclosed cumulative effects of multiple management programs on air quality, recreation, mining, grazing, and timber harvest. The discussions are summarized below. Relationships of the proposed changes considered in this document to these resources are also discussed.

Air Quality

Forest Service burn permits consistently account for less that 5% of burn permits issued in California. The agency has executed a memorandum of understanding (MOU) for prescribed burning with the California Air Resources Control Board. The MOU describes the procedures by which the Forest Service can complete prescribed fire projects in ways that are consistent with state air quality standards. These procedures would not change under any alternative, and all the alternatives would therefore be consistent with the program for managing burning on all ownerships in California. Likewise, the agency will ensure compliance with the Nevada Smoke Management Plan in any prescribed burn activities. The proposed changes considered in this document (Alternative S2) will continue to allow national forests to be managed in ways that help both states maintain air quality complying with the Clean Air Act.

Recreation

As stated in the FEIS, the demand for recreation will continue to increase in the Sierra Nevada, and the national forests will satisfy most of the demand. Demand will increase across the spectrum of recreation activities. The FEIS noted that the overall supply of recreation would vary only in Alternatives 3 and 5, under which off-highway vehicle (OHV) use would be reduced. The analysis in the FEIS indicated that reduction in OHV opportunities under Alternatives 3 and 5 could shift use to other ownerships, but neither of these alternative was chosen in the SNFPA ROD. Therefore, the national forests should be regarded as the primary source of public recreation in the Sierra Nevada in the future. The proposed changes considered in this document (Alternative S2) would not change the types or range-wide availability of recreational opportunities from those anticipated under current direction (Alternative S1).

Mining

About 58% of the 11,800 mines in the Sierra Nevada are located on national forest lands; however, most of the active mines are located off of the national forests. Mines on national forests presently yield few mineral products. With the exception of one mine on the Inyo National Forest, they do not contribute significantly to regional or national outputs. Large changes in production are unlikely. The proposed changes considered in this document would have no effect on this situation.

Grazing

Grazing on public lands continues to decline in the Sierra Nevada and across the west, as increasing emphasis is given to protecting water quality, fish and wildlife, recreation, and other resources. However, many ranchers in the region still depend on national forest range allotments for maintaining their operations. The FEIS concluded that declines in cattle grazing would occur under all the alternatives. The reductions would range from 30,000 to 50,000 animal unit months (AUMs) under Alternatives 1 and 4 to as much as 160,000 AUMs under Alternatives 2 and 8. The effects of Alternative S1 and S2 are within this range. These reductions are not expected to produce significant shortages in beef supply for California or the Sierra Nevada. However, they will have direct effects on some families and communities in the Sierra Nevada. The number of families affected and the overall economic impact is difficult to quantify at this time, because it is impossible to determine the number of families that would abandon their ranching operations in response to national forest management.

Timber Harvest

In the years immediately preceding the FEIS, about one fifth of the timber volume from the Sierra Nevada was produced from the national forests. The remainder was harvested from private lands. Alternatives 4 and 7 in the FEIS would increase harvest from the national forests. Alternative 2, 3, 5, 6, 8, and Modified 8 would decrease timber production by the Forest Service. None of the alternatives (including S1 and S2) would make sufficient changes to shift the overall proportion of production between public and private land.

In Nevada, the Nevada Forest Practice Act of 1955 regulates timber management on private lands. Timber management on private land in California is regulated by the California State Board of Forestry and Fire Protection through its *Forest Practice Rules*. The recent trend in the forest practice rulemaking has been to provide increasing protection for water, fish, and wildlife. Additional protections are now being contemplated by the Board of Forestry and the California Legislature.

The overall finding from this assessment is that the proposed changes (Alternative S2) would permit an increased level of timber harvest from the national forests. The estimated green sawtimber yield from S2 would be 330 MMBF/year. The current statewide lumber consumption is estimated to be about 9,000 MMBF/year; S2 could contribute about 4% of the estimated need. California presently imports about 2/3rds of its lumber products and an even larger share of other wood products (Laaksonen-Craig et al. undated). The proposed changes will not significantly increase the wood supply for California.

4.2. Physical and Biological Environment

4.2.1. Old Forest Ecosystems

Factors Used to Assess Environmental Consequences

Three factors were used in the FEIS to evaluate consequences of the alternatives on old forest ecosystems:

- amount and distribution of old forest;
- fire risk and hazard, and predicted losses to wildfire; and
- old forest functions and processes.

In addition to the factors considered in the FEIS, the consequences of potential drought and insect/pathogen outbreaks are addressed in this document. In this section, consequences in relation to drought, insects, and pathogens are tiered to the more detailed discussion regarding forest ecosystem health in section 4.2.2 below.

Assumptions and Limitations

Drought, Insects and Pathogens

While most insects and pathogens found in the project area are native and continue to play important roles in old forest processes and functions, the scale and magnitude of mortality events due to insects, pathogens, and drought are thought to have changed since pre-settlement conditions (Ferrell 1996). High levels of mortality over extensive areas, particularly of large/old trees, can have major consequences to old forest structure, composition, and function. Given the restricted amount and distribution of old forest in large patches (>100 acres) or blocks (>1,000 acres), any severe mortality event can be a significant loss of the remaining old forests.

Alternatives S1 and S2 were evaluated qualitatively to identify likely changes in the potential for extensive, high severity, insect/pathogen-related mortality events. The relative susceptibility of forest types and locations to drought and insect/pathogen-related mortality was considered. This analysis included typical precipitation patterns, forest composition, and forest density. Forest types in the drier portions of the landscapes (low average annual precipitation) and near the limits of the environmental tolerances for the type's species (e.g. lower limit of precipitation where they can survive) were assumed to be the most susceptible. These types include all montane eastside forests (eastside pine, eastside mixed conifer, and eastside white fir types) and most of the lower montane westside forests (ponderosa pine and lower elevation mixed conifer types).

Several aspects to the response of old growth forests to drought and insect/pathogen-related mortality discussed in the forest and vegetation health section of chapter 3 are summarized as follows. First, recent research has shown that large, and often older, trees respond differently to drought than smaller trees. Differences in response may also depend upon the climatic regime under which the tree developed; hence responses may differ by tree age. Research on drought response in relation to tree size in coniferous forests of the western United States has revealed that large trees can be more resilient to drought due to greater and longer access to soil water because of deeper roots and increased water storage capacity in boles and large branches (Williams et al. 2001, Ryan et al. 2000, and Phillips et al. 2003). The deeper roots may be particularly pronounced when the trees have developed during drier climatic regimes, because of greater allocation of energy to root production during these conditions (Williams et al. 2001). As discussed in the forest and vegetation health section, the most recent 150 years have been relatively wet. Therefore, large trees more than 150 years ago would have developed deeper root systems, making them more resilient to drought. The degree of advantage of deep roots depends in part on subsurface water and soil conditions. The implication of this research is not that large, old growth trees are immune to drought or drought-related insect/pathogen mortality but that stand density guidelines for forest health, which have been developed in younger forests, may not be directly applicable to older forests. Older forests may be able to develop greater basal areas than younger forests having similar terrain conditions.

Despite the potentially greater resilience of large and, especially, older trees to drought their numbers are considered to be below desired levels in the Sierra Nevada, particularly in the eastside and ponderosa pine-dominated forests. Therefore, reducing competition for water and nutrients by removing dense growth of small trees is important to the survival of large, old trees.

Progress toward Desired Conditions for Old Forest

In the FEIS one of the indicators/measures used to address consequences to old forest ecosystems was *historic conditions as a management reference*. Both Alternatives S1 and S2 target desired conditions for old forest that are based in part on historic conditions. They differ in the degree of emphasis on desired conditions and the rate of progress that would be made toward achieving these conditions. Thus, the measure has been replaced with an indicator of *progress made toward achieving desired conditions in old forests*. This indicator/measure incorporates desired conditions of old forest at both local and bioregional scales. At the local scale, desired future conditions are specified in terms of overall characteristics that entail heterogeneity in structure and composition over landscapes. At the bioregional scale, the amount, location, and distribution of old forest emphasis areas encompass desired conditions for old forest that include

- high levels of old forest patch types;
- large blocks of old forest based on best remaining landscape concentrations;
- completeness of landscape units, and their associated genetic and ecological variability; and
- persistence of known (and unknown) old forest-associated species, processes, and functions (Franklin et al. 1996b).

Franklin et al. (1996b) discussed the importance of conserving large blocks of old forest to ensure that the full array of old forest functions persists in the Sierra Nevada. Their reasons included the following.

- Large contiguous areas of high quality late-successional old growth (LSOG) forests did occur in the presettlement landscape of the Sierra Nevada.
- A habitat requirement for large blocks of LSOG forest has been neither proven or disproven for vertebrate species in the Sierra Nevada.
- Large LSOG blocks are important to ensure that landscape units—and their associated genetic and ecological variability—are incorporated within the LSOG conservation strategy.
- Large LSOG blocks are important to incorporate natural patterns of disturbance and successional stage resulting in complex mosaics typical of high-quality LSOG forests.

In the Sierra Nevada, some evidence suggests that some vertebrates may require large blocks of late-successional forest habitats for their long-term persistence. For example, model simulations of California spotted owl demographics indicate this species will persist longer under a conservation strategy with fewer, large reserves (each sufficient for 10-20 owl pairs) than one with many small reserves (each sufficient for 1-3 owl pairs) (Andersen and Mahato 1995).

Since the FEIS was issued, research on habitat-demographic relationships for the California spotted owl in westside forests of the Lassen Demographic Study area suggests the correlation between old forest characteristics (including large trees at the patch and landscape scale) and owl reproductive is stronger than previously believed (Blakesley 2003). Further research is needed to determine if similar relationships prevail in other portions of the owl's range. Previously, some disparity has resulted between environmental effects analysis for California spotted owl emphasizing California Wildlife Habitat Relationships (CWHR) habitat type classification (focusing on tree size class and canopy cover) and those emphasizing both CWHR stand classification and old forest classifications (focusing on large tree densities and canopy cover) (Franklin and Fites-Kaufman 1996).

Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 151-161.

The following effects are based on the modeled time horizon from 1 to 15 decades.

Fire Risk and Hazard and Predicted Losses to Severe Fire

Direct and Indirect Effects

The annual acreage burned by wildfires is expected to decrease under both Alternatives S1 and S2. On an annual basis, approximately 12,000 fewer acres would be expected to burn under Alternative S2 than under Alternative S1.

Of more importance to old forests is the probability of future fires in concentrations of existing old forest and the level of mortality associated with these fires. Alternative S1 involves a strategic fuels reduction approach, in which watersheds with the highest fire hazard and risk ratings have highest priority for treatment. Alternative S1 includes a standard and guideline directing managers to focus on the low elevation mixed conifer and ponderosa pine ecosystems that have the highest fire hazard and risk. The standards and guidelines affecting fuel treatments (including limited operating periods for burning) under Alternative S1 would also apply in areas likely to contain concentrations of old forest habitat used by California spotted owl and Pacific fisher. Their presence may delay implementation of planned activities, or alternative prescriptions may need to be developed, which could result in retention of higher fuel levels. Therefore, Alternative S1 will only slightly reduce the risk of losing old forests to high severity fire, compared to a no-treatment regime.

Alternative S2 includes fewer restrictions on fuel treatment methods, making treatments more effective in changing fire behavior, fire severity, and acreage burned. With an initial spatial emphasis on the *wildland-urban intermix* (WUI), fuel hazard reductions across the broader landscape will be limited. When treatments within WUI are completed, old forest patches would begin to benefit from implementation of *strategically-placed area treatments* (see chapter 3). Successful implementation of this fuels reduction strategy is projected to moderately reduce the risk of losing old forest to high severity fire compared to a no treatment regime.

Cumulative Effects

Increases in population growth in California, development in the WUI, and concerns over air pollution are likely to cumulatively affect fire risk and hazard and predicted losses to severe fire. The number of ignitions and fire risk are likely to increase with increased populations and development in the WUI. Current zones of highest ignitions and fire risk often coincide with areas of high human influence. However, this pattern could be altered with increased fire prevention and education (Cole and Kaufman 1966, Doolittle and Welch 1974, Folkman 1973 and 1975, and the California Fire Plan at http://frap.cdf.ca.gov/fire_plan). Air pollution in the southern Sierra Nevada is showing signs of affecting forest vigor, as evidenced by increasing litter production rates and surface fuel accumulations in pine-dominated forests. Decreased vigor predisposes trees to a higher likelihood of mortality, especially following stressful events such as wildfire.

Drought and related insect/pathogen related mortality are likely to cumulatively affect old forest. Drought can lead to direct mortality and indirect mortality from insect/pathogen infestations, and increase the potential for high severity fire in old forests. Drought effects could be particularly high in the mixed conifer and yellow pine (ponderosa and Jeffrey pine) forests of the southern Sierra Nevada, in westside ponderosa pine forests and low elevation mixed conifer forests where average annual precipitation is low, and in eastside pine, mixed conifer, and white fir forests.

Amount and Distribution of Old Forest Conditions

Large or Old Tree Element

Both alternatives restrict the removal of larger trees. The difference between the two alternatives is expected to be less than 5% after the first 7 decades and less than 10% after fifteen decades. Numbers of trees ≥30 and >50 inches in diameter are projected to increase faster under Alternative S2, primarily due to the lower level of wildlife-related mortality projected under this alternative.

Old Forest Patches

Strategically placed area treatments will extend into portions of old forest patches under both alternatives. Both a spatial simulation of old forest patch types, classified using CWHR classes for closed-canopied late seral forest and Sierra Nevada Ecosystem Project (SNEP) LSOG ranks (Sessions et al. 1997), and qualitative assessment of the effects of the land allocations and standards and guidelines were used to assess consequences. The total acreage of old forest patches, defined as SNEP LSOG rank 4 and 5 (Sessions et al.1997) was projected to increase under both Alternative S1 and S2. Until the 6th decade, S2 increases at a slower rate than S1, however, S2 then increases much faster than S1 through the remaining planning period.

CWHR Late Seral, Closed-Canopied Patches

Alternatives S1 and S2 are projected to have approximately the same acreage of CWHR type 5M, 5D, or 6 stands (moderate to dense cover stands with trees >24 inch diameter at breast height [dbh]) for the first 7 decades. Forest stand simulation modeling then predicts an increase in CWHR type 5M and 5D stand acreages under Alternative S2 thereafter, primarily through the lower level of projected wildfire projected under this alternative.

Old Forest Ecosystem Functions and Processes

Fire as a Process

Projections for prescribed burning are about 50,000 acres per year under Alternative S1 and 42,000 acres per year under Alternative S2. Because Alternative S1 emphasizes restoration of fire as a process in the old forest emphasis areas, prescribed fire treatments may be attempted more often under this alternative. However, the increased use of mechanical treatments under Alternative S2 may increase the feasibility of subsequent prescribed fire treatments, making Alternative S2 more likely to involve use of prescribed fire in future treatments. The actual difference between these alternatives would depend upon the site-specific variables of the locations selected for treatment.

Connectivity

Connectivity of old forests blocks and patches is provided to some degree under both alternatives through management direction for

- old forest emphasis areas,
- riparian zones,

- protected activity centers, and
- general forest desired conditions.

Large blocks managed for enhancement of old forest characteristics provide the greatest degree of connectivity for all modes and distances of movement, because old forest would be present at multiple scales and would be the most continuously distributed.

The alternatives will result in similar levels of old forest connectivity. They involve the same management allocation of old forests. Both include large, dedicated blocks of old forest with similar levels of connectivity.

In eastside forest types, the lack of canopy cover retention standards under Alternative S2 would lead to fewer areas of the landscape having moderate to dense canopy cover. However, moderate to dense canopy cover was likely to have been an uncommon historical condition in these systems.

Effects on connectivity in the Herger-Feinstein Quincy Library Group (HFQLG) pilot project area would differ between the alternatives, primarily in areas where small group selection units or defensible fuel profile zones (DFPZs) are placed. The varying levels of residual trees, including all those ≥30 inches dbh, would tend to blur the distinction between edge and interior of post-treatment stands.

Cumulative Effects Related to Connectivity

The cumulative effect of wildfire on old forest connectivity would vary by alternative and location in the Sierra Nevada. Large, stand-replacing fires may create gaps in forest cover that extend for several miles (e.g. the Stanislaus Complex of 1987). The westside of the southern Sierra Nevada is particularly vulnerable to losses of forest connectivity because montane and upper montane forests occur in an inherently narrow elevation band. The increased wildfire losses anticipated under Alternative S1 would likely result in greater losses of connectivity than under Alternative S2, with resultant temporary gaps in mid to late seral habitat.

Representativeness

While absolute quantities are expected to differ, both alternatives ensure representation of a diversity of old forest characteristics, because they both provide a distribution of old forests across landscapes.

Progress toward Desired Conditions for Old Forest

Local, Watershed Scale

Canopy cover objectives are higher under Alternative S1 than under Alternative S2. Continued tree growth, especially within moderate and high density forests, will, absent disturbance, increase canopy cover under both alternatives. Projected canopy cover differences would vary over time but are no, over the span of 15 decades, expected to differ between the alternatives by more than 2%.

The lack of canopy cover restrictions for fuel treatments across much of the eastside pine landscape under Alternative S2 would enhance the likelihood that shade-intolerant ponderosa and Jeffrey pine would increase relative to Alternative S1. In westside forests, the slight differences in canopy cover retention standards between the alternatives would result in little or no difference at this scale.

Both alternatives allow purposeful reforestation efforts. When treatment-unit-wide canopy cover objectives are met, shade-intolerant species may be established. Restoration of pine species is expected to occur under both alternatives. The increased availability of mechanical treatment options under Alternative S2 may result in increased openings that are suitable for successful regeneration over a greater portion of the planning area. Under both alternatives of a specific strategy to provide for restoration of shade-intolerant species precludes a more detailed projection of effects.

Bioregional Scale

Both of the alternatives address desired conditions for old forest at the bioregional scale with a spatially explicit delineation of an *Old Forest Emphasis Area* (OFEA) land allocation. However, the two alternatives vary in consequences to the four key elements described under assumptions and measures:

- levels of old forest patch types,
- blocks of old forest based on best remaining landscape concentrations,
- ensuring complete landscape units—and their associated genetic and ecological variability—are incorporated, and
- maintenance of unknown old-forest-associated species, processes, and functions.

Under Alternative S1, specific standards and guidelines prescribe management practices in OFEAs that are different than for other allocations. These include minimizing mechanical treatments, which would reduce effects to old forest associated species, processes, and functions. While these standards and guidelines would be applied to entire OFEAs under Alternative S1, the consequences to old forest ecosystems are particularly important for the remaining large blocks of old forest represented by highly ranked SNEP LSOG polygons and identified in the SNEP Area of Late Successional Emphasis system.

Alternative S2 allows for a more active effort to manage OFEA conditions toward desired conditions. The increased efficiency provided by mechanical treatments should increase the acreage where fuel hazards are low enough to reduce large tree mortality during wildfire.

Under both alternatives, within portions of the HFQLG pilot project area, there is a high proportion of core OFEAs and remaining large blocks in offbase and deferred allocations. The offbase and deferred areas overlap with a significant proportion of the LSOG rank 4 and 5 and SNEP ALSEs. These areas would not be treated until the end of the HFQLG pilot project, at which time, they could be considered for treatment, under Alternative S2.

The impacts of wildfire and/or insect/drought-related mortality may be greater under Alternative S1, because of the limited set of treatment options available. Under Alternative S2, efforts to overlap treatment areas with old forest patches would be expected to result in more effective fuel reduction and increased levels of density reduction, which are key elements of the desired condition.

4.2.2. Forest and Vegetation Health

Factors Used to Assess Environmental Consequences

Vegetation Density and Composition

Consequences to vegetation density and composition were based upon likely changes toward desired conditions (FEIS volume I, chapter 2, pages 136-143). Particular focus was placed on those ecosystems and forest types having changed the most in density and composition since European settlement, and on those most at risk of severe mortality from drought, insect or pathogen attack. Likely changes were estimated based on the amount, location, and type of planned treatments and from standards and guidelines governing vegetation management.

Insects, Pathogens, and Abiotic Factors

Measures for analysis of effects of alternatives on insect and pathogen infestation were established as follows:

- amount and location of forests available for treatment of vegetation,

- ability to suppress outbreaks through direct removal of trees,
- creation of slash, and
- potential fire damage.

Regeneration

Three measures were used to evaluate consequences of the alternatives to regeneration of forest stands:

- acreage treated mechanically or by prescribed fire,
- acreage harvested by group selection or other regeneration methods, and
- acreage burned by wildfire.

Assumptions and Limitations

Location, severity, and length of drought are important factors in determining mortality levels due to insects and pathogens. This mortality would typically result in openings that range from less than 1/4 acre to 50 acres or sometimes more, and an increase in the amount of standing dead and down woody material.

Mortality related to insects or pathogens would have multiple possible consequences, for example:

- a continuing need/opportunity to enter stands to conduct salvage operations;
- increased fuel levels;
- more snags and down woody material;
- fewer large, older trees and fewer mid-diameter trees, which represent the pool from which large trees of the future will come;
- reduction in crown closure and loss of wildlife habitat;
- a short term increase in nutrient cycling;
- a possible increase in hazard trees;
- fewer trees/acre
- species diversity changes; and
- a change in species composition.

The importance of these effects depends on the severity and extent of mortality and, ultimately, how mortality affects ecosystem structure and function and specific management goals and objectives.

Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 79-107.

Forest Density and Composition

Alternatives S1 and S2 would focus fuels reduction treatments in the defense zone of the WUI and in a strategic pattern of area treatments across the threat zones of WUI and into the wildlands. Area treatments would be distributed across the landscape, rather than concentrated in portions of the landscape. Although the pattern of treatments would be similar under both alternatives, prescriptions would differ. In general, treatments under Alternative S2 would remove more woody fuel and allow for more density reduction within forested stands.

Since strategically placed treatments would not necessarily be focused where forest density is highest and hazard is greatest, the rate of change towards desired conditions, density reductions, and pine restoration would be less than if treatments were focused upon the areas of highest risk.

Alternative S2 allows greater reduction in canopy cover in eastside pine ecosystems. This allowance would enhance the likelihood of stands moving toward desired conditions, restoration of pine species, and reduced stand densities. Under Alternative S2, DFPZs in the HFQLG area are more likely to be placed on upper slopes or ridgetop positions. The resulting stand structure in DFPZs would be characterized by decreased tree density, increasing the opportunity for establishment of shade-intolerant tree species.

Group selection units, by definition, are not density-reduction treatments; they are created to regenerate a portion of the forest. However, under both alternatives when the groups contain trees ≥30 inches in diameter, these trees would remain within the unit. The spatial arrangement of the retained trees would determine if density is appropriate. The removal of the smaller trees would enhance the vigor of the remaining trees; however, if the remaining trees were closely spaced, intertree competition would continue to affect them. Trees on the edge of the opening would likewise benefit from the removal of neighboring smaller trees; however, they would continue to be affected by the remaining larger adjacent trees.

Under either alternative, group selection would provide a favorable environment for the establishment of shade-intolerant pines. A greater acreage in group selection under Alternative S2 is likely to provide more opportunities to reestablish pine in places where they have been replaced or removed.

Table 4.2.2a illustrates the extent of treatment unit acreage under Alternatives S1 and S2 that could reduce density within moderate-high density strata. (Tree density can be inferred by canopy cover measurements; higher levels of canopy cover imply higher tree density. Strata labels that include "N" indicate that estimated canopy coverage ranges from 40 to 69%. The "G" label indicates that canopy coverage is >70%. The associated number indicates crown width [diameter] group, ranging from 2 [width <12 feet], the smallest, to 5 [width >40 feet], the largest.)

Implementation of Alternative S2 would affect a larger portion of lands having moderate-high density cover, because the availability of mechanical treatments would result in removal of more trees that are contributing to density/drought hazards. As modeled, from a bioregional standpoint, under Alternative S2 only 29% of the acreage of moderate-high density strata would be eligible for treatment. An estimated 71% of the acreage of the selected strata acreage would not be affected by projected treatments. Under Alternative S1, even fewer acres would be treated.

Table 4.2.2a. Acres of Moderate-High Density Canopy Cover.

Treatment Area	Strata							Total
	2G	2N	3G	3N	4G	4N	5G	
Alternative S1								
No treatment	7,822	202,620	359,384	1,744,985	382,496	452,925	45,065	3,195,296
DFPZ	349	6,429	16,989	49,947	17,962	18,818	3,829	114,323
Defense zone	311	1,800	16,199	76,846	23,900	23,605	1,080	143,741
Group selection	113	1,086	2,573	8,496	1,895	4,673	219	19,055
Threat zone treatments	844	5,577	25,977	106,554	31,858	31,325	2,284	204,418
Wildland treatments	1,295	49,844	61,463	264,512	63,954	76,128	10,131	527,327
Total, S1	**10,733**	**267,356**	**482,585**	**2,251,340**	**522,066**	**607,474**	**62,608**	**4,204,160**
Alternative S2								
No treatment	7,621	195,599	349,429	1,696,123	375,856	440,611	42,999	3,108,237
DFPZ	540	14,648	28,357	109,402	25,625	29,587	6,098	214,256
Defense zone	273	1,778	14,609	73,333	22,857	22,750	777	136,377
Group selection	256	2,307	5,456	18,016	3,885	9,962	457	40,340
Threat zone treatments	793	5,327	23,992	99,979	28,583	28,622	2,031	189,326
Wildland treatments	1,250	47,698	60,742	254,487	65,259	75,943	10,246	515,625
Total, S2	**10,733**	**267,356**	**482,585**	**2,251,340**	**522,066**	**607,474**	**62,608**	**4,204,160**

(Source: USDA Forest Service, Pacific Southwest Region 2003d)

Insects and Pathogens

Direct effects related to insects and pathogens can be altered through pest prevention and suppression. Effects become disproportionately larger as infestation acreage increases. Modification of tree vigor via density reduction, prevention of tree damage from prescribed fire, and pathogen control efforts can indirectly reduce the potential magnitude of insect and pathogen effects. Direct suppression efforts against Jeffrey pine beetle, by removing infested trees while the beetles are still developing, may reduce the extent of mortality. Treatment or removal of slash can limit the potential for damage from the *Ips* beetle. Areas heavily infested with dwarf mistletoe or root diseases, or within areas affected by white pine blister rust, can be reforested with resistant tree species to limit the spread and effects of these pathogens.

The combined effects of density reduction and pathogen control measures are likely to sustain high vigor of trees, which offers increased resistance to the adverse effects of drought and wildfire.

Insect/disease prevention activities are designed to promote tree health and vigor and limit resource damage and mortality. *Suppression/prevention* means the reduction of insect- or disease-related damage or mortality to acceptable rates through the application of silvicultural techniques, utilizing one or more mechanical, chemical, or biological control methods.

During periods of normal precipitation, timely opportunities exist for reducing tree density and thereby increasing health and vigor of remaining trees. Actions taken to reduce density during periods of below normal precipitation come too late, as the capacity of a tree to show increased vigor when under environmental stress is limited. Historical observations clearly show that mortality from bark and engraver beetles increases during drought periods, with higher levels of mortality detected during sustained drought periods. While effects are widespread, observations during the most recent protracted dry period indicate that much of drought mortality occurs in the areas that normally receive annual precipitation of 40 inches or less. Considering insects, pathogens, and abiotic influences, the environmental consequences of implementing the alternatives are directly related to

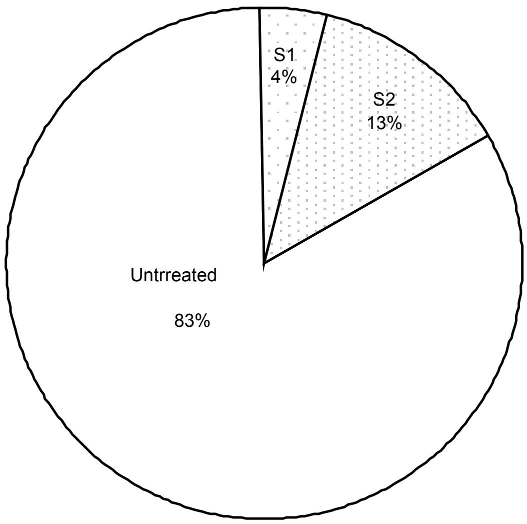
- implementation of vegetation management activities (thinning) intended to create vigorous and healthy growing conditions that are likely to reduce/prevent insect and diseased-related damage or mortality,
- implementation of direct suppression efforts against Jeffrey pine beetle,
- amount of green slash created and the length of time that slash remains in a state that constitutes a suitable host for *Ips* beetles,
- bark beetle-related mortality associated with trees damaged by prescribed fire or wildfire,
- regeneration of areas that are heavily infested with dwarf mistletoe or root diseases, and
- extent of planting seedlings of rust-resistant sugar pine, as well as the other 5-needle pines, to ensure recruitment into future stands.

Thinning

The management of tree density can influence mortality rates. Research (Oliver and Uzoh 1997) suggests threshold levels of increased intertree competition that lead to increased mortality rates. Using these stand density index (SDI) thresholds, forest inventory data for the bioregion was analyzed. Actual strata density averages were compared to SDI values for various precipitation zones. This data was compared to anticipated treatment acreages for Alternatives S1 and S2. These alternatives differ in the availability of mechanical treatments that could reduce tree density, with S2 providing greater opportunities. Figure 4.2.2a illustrates the difference between Alternatives S1 and S2. Under Alternative S1, the projected acreage of density reduction that would decrease mortality from insect/drought is 4% of the 2,138,000 acres rated as high or extremely susceptible to such mortality (USDA Forest Health Protection Program 2003 unpublished file data). Under Alternative S2, the percentage would increase to 13%. Depending on specific diameter distributions of existing stands, which will affect the diameter distribution of the 40% of basal area that must be retained under Alternative S2, these density reduction treatments would result in increased tree vigor. The acreage remaining untreated under either alternative will continue to accumulate biomass and be subject to stress factors previously described.

Because some normal *fire cycles* have not occurred in some forests due to fire suppression, tree density reductions due to fire-caused mortality of seedlings, saplings, and poles have also not occurred. Furthermore, as fuel-laden forests are at risk from lightning strikes, dense clumps of trees are at risk from the combination of insects, pathogens, and drought. As surface fuel continues to accumulate, fuel ladders increase in size and frequency, and crown mass increases, the probability of fire-caused mortality increases in these areas.

Figure 4.2.2a. Amount of Effective Density Reduction Treatment in Stands Having Extreme or High Susceptibility to Mortality.



(Source: USDA Forest Service, Forest Health Protection Program 2003)

In summary, while tree density would be reduced more extensively under Alternative S2 than under Alternative S1, the total treated acreages in either case would be too small to significantly benefit the bioregional condition.

Direct Suppression

Tree Removal

Removal of infested trees is an option to reduce Jeffrey pine mortality where Jeffrey pine beetle infestations occur in areas where mechanical treatments are allowed. Alternative S1 requires a determination that the mortality has caused a stand-replacing event and that the removal would benefit landscape goals. Alternative S2 permits salvage of dead and dying trees in OFEA allocations. In certain cases (e.g. removal of trees infested with bark beetles), Alternative S2 may reduce tree mortality. This result would be most commonly attained on lands accessible by road systems. Remote/scattered mortality will remain difficult to prevent. These limitations also apply to suppression of root disease.

The ability to treat pathogens, such as *Phytophthora ramorum*, the fungus-like organism responsible for Sudden Oak Death Syndrome, may be limited in both S1 and S2. If effective treatments require significant mechanical alterations, e.g. multiple tree removal and/or root removal, it may be necessary to prepare a site-specific amendment to the Forest Plan.

Slash Treatment

Pine engravers such as *Ips paraconfusus* and *Ips pini* periodically infest recently-created pine slash. Host material can be created through wind events, snow breakage, or tree harvesting activities. Residual trees can be attacked simultaneously when pine engravers are infesting the slash or later by emergent populations that have developed in the slash. Attacks to residual trees can result in top kill and/or whole tree mortality. The alternatives vary somewhat in the amount of slash that would be created, based upon the level of management activities. The ability to deal with green slash not created by tree harvesting, such as the result of a windthrow event, seem low, especially if such an event occurred beyond the WUI, because of the current and projected priorities for fuels treatments and budget allocations.

Fire-Damaged Trees

Projected wildfire acreages begin at approximately 60,000 acres per year. Within 30 years, Alternative S2 reduces annual wildfire acreage by approximately 10,000 acres/year. Trees that are not killed outright by the fires, but have sustained fire-related injuries to either the crown or cambium, may be at higher risk to bark beetle attacks for a few years following a fire. However, observations made up to five years after wildfires have not shown significant increases in bark beetle activity or mortality.

Conifers in areas treated by prescribed fire would be susceptible to bark beetle attack for 1-2 years, especially if the residual trees sustain fire-related injuries. Attacks by red turpentine beetles, *Dendroctonus valens*, are very common in pine stands following prescribed fires. Further studies are required to determine what role they may play in causing additional tree mortality. The projected use of prescribed fire as the initial treatment under Alternative S2 is 7,590 acres less per year than under Alternative S1. Under Alternative S2, exclusive of the HFQLG pilot project area, about 31,590 more acres per year would be burned as follow-up to initial treatments. Prescribed fire intensity in these areas may be less, however, especially where mechanical treatment was used initially. Where prescribed fire was used as the initial treatment, follow-up prescribed burning may be of higher intensity, because fire-killed vegetation would become fuel for the second burn.

Reforestation

Reducing dwarf mistletoe infestation, either through the removal of infected overstory trees or regeneration of affected areas with resistant species, is required to reduce future mortality as a result of mistletoe/insect interaction. Group selection openings in the HFQLG pilot project area (24,000 acres in Alternative S1 and 52,200 acres in Alternative S2) could provide limited options for reducing dwarf mistletoe impacts. If group selection openings could be located to overlap infections, dwarf mistletoe impacts could be reduced. However, the 30" diameter limit under both alternatives would require planting of resistant species for effective reductions to be possible. Outside of the HFQLG pilot project area, the removal of infected trees, while constrained by treatment unit objectives, may provide for small reductions of mistletoe levels. Restrictions on canopy cover reduction and the upper limit on harvest tree diameters will prevent removal of some infestations in overstory trees. In S2, without the 12- and 20-inch tree removal limits, a more effective reduction of mistletoe infection levels is possible.

The future of the five-needled pines, especially sugar pine, is largely dependent on the successful establishment of rust-resistant seedlings. The vast majority of existing trees are susceptible to the rust, especially during *wave* years, when climatic conditions provide ideal conditions for high levels of infection. The ability to conduct salvage harvests of dead trees after some disturbance event (windthrow, fire, and drought) under Alternative S2 could allow reforestation of rust-resistant sugar pine. Reforestation within existing openings and under low-density forest cover could provide additional areas for regeneration of shade-intolerant pines, rust-resistant 5-needle pines, and/or alternative species that are needed to meet other objectives.

Regeneration

General

Both alternatives would limit reductions in canopy closure, so that average values are projected to increase over time. Shade-tolerant species will continue to be favored by this approach. Ponderosa pine, black oak and, to a lesser degree, sugar pine, madrone, and other species with intermediate shade tolerance are not favored. However, when criteria in standards and guidelines for canopy cover are met, openings may be employed to develop regeneration for any complimentary purpose, for example, the establishment of pine species. The suitability of openings becomes disproportionately greater as opening acreage increases. However, neither alternative employs a specific strategy to reestablish pines removed for utilization by society or killed by insects or pathogens.

Since both alternatives involve the same land allocations, with differences in thinning intensity on the managed land base, differences in seedling recruitment will be insignificant, with the exception of areas burned by stand-replacing wildfire and group selection areas (on the HFQLG landbase).

Acres outside of treatment areas would provide limited opportunity for regeneration and recruitment of shade-intolerant trees. Unless disturbance events create larger openings, regeneration would occur mostly in tree-fall gaps. In small gaps, about ¼ acre in size, shade, root competition, and other factors discussed above tend to favor white fir and other shade-tolerant species. Environmental conditions within larger gaps, generally >½ acre, where root competition and shade are not as limiting, are better suited for the establishment of ponderosa pine, black oak, and sugar pine. Regeneration in unmanaged and closed canopy forests would generally be low.

Initial treatment areas are expected to be subsequently treated, commonly by prescribed fire, to maintain reduced levels of surface fuel. These treatments would likely limit regeneration, except in units where regeneration is being cultured. Such culturing would occur under both alternatives, to favor species composition goals.

Comparing composition of seedlings less than 30 years of age in mixed conifer stands growing on highly productive sites in northern California, Lilieholm (1990) found that ponderosa pine was not present under a heavy overstory in unmanaged stands. However, active management to favor shade intolerant species in small openings did allow ponderosa pine (intolerant) and sugar pine (intermediate) to persist in stands having an 8-12 year re-entry cutting cycle. This finding indicates that where relatively high stocking is retained on highly and moderately productive sites, some active management is needed to encourage recruitment of shade intolerant species for future stand development. If regeneration is expected to eventually become part of the primary canopy, light and other resources need to be provided for young trees to shift from persistence to high vigor.

Small Group Regeneration on HFQLG Forests

Group selection is a regeneration method employed as part of an uneven-aged silvicultural system. It is specifically authorized by provisions of the HFQLG Forest Recovery Act and is expected to be fully implemented by 2009. Over the next five years, Alternative S2 would allow creation of 28,200 more acres of group selection than would Alternative S1.

Small group regeneration provides for the control of species composition through planting or management of natural regeneration. Seedling survival, growth, and composition may be managed at the time of initial planting, as well as during follow-up treatments that control competing vegetation and reduce density.

Stand Replacement Events

Openings are expected to be created from *stand-replacing events*, such as fire or large scale mortality caused by insects or pathogens. Stand replacing wildfire is estimated to range between 14,000 and 17,000 acres over the planning period. The effects of S2 treatments reduce this value to approximately 10,000 acres by the fourth decade. Probable extents of openings caused by insects or pathogens are difficult to estimate; however, the uncharacteristically high current densities of these agents my lead to openings larger and more widespread than observed in recent decades. The restoration process may involve salvage harvesting of selected trees, reforestation, and the establishment of other desired vegetation. Commonly, rehabilitation activities to protect soil, water quality, and wildlife habitat are also carried out. These infestation events provide opportunities to manage tree species composition through planting, natural seeding, and follow-up treatments.

Hardwoods, including black oak, tanoak, and live oak, commonly resprout from the root collar after top-killing events, like fire. Germinating acorns also contribute to regeneration of oak. In some cases, resprouting hardwood trees, particularly tanoak, compete with conifers for growing space and moisture. Standards and guidelines in both alternatives would favor hardwood regeneration by restricting planting of conifer seedlings in proximity to hardwoods.

Natural seed sources may be inadequate to support regeneration after large, high intensity fires. McDonald (1980) observed that 89% or more of sound seeds of ponderosa pine, Douglas fir, white fir, and incense cedar fell within about 200 feet of the parent trees. Though some seed may travel farther, the probability that openings will receive adequate seed decreases sharply with increasing distance from the parent. Planting openings may be essential to assure adequate conifer regeneration.

Planting would be the primary method employed to achieve species composition objectives under both alternatives. Planting would be especially valuable when reestablishing sugar pine, as parent trees are unlikely to be resistant to white pine blister rust.

4.2.3. Aquatic, Riparian, and Meadow Ecosystems

Methods Used to Assess Environmental Consequences

The FEIS (Volume 1, Chapter 2, pages 40-50) and SNFPA ROD (Appendix A, pages A-5 to A-9) outline an Aquatic Management Strategy (AMS). The AMS includes goals that describe desired landscape-level conditions for aquatic, riparian, and meadow ecosystems; important land allocations such as riparian conservation areas (RCAs) and critical aquatic refuges (CARs) needed to attain these goals; riparian conservation objectives (RCOs) and specific standards and guidelines pertaining to management activities in these allocations and other areas; and landscape analysis. Alternatives S1 and S2 both include a comprehensive AMS and with the exception of the few Standards and Guidelines described below, the components of each are the same. Besides these differences, Alternatives S1 and S2 include minor clarifications to the standards.

Environmental consequences for aquatic, riparian, and meadow ecosystems associated with Alternatives S1 and S2 are described below. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 227-237.

These consequences were assessed by estimating the relative effectiveness of the land management activities and management direction proposed by the alternatives in meeting the AMS goals. The FEIS identified several factors used to evaluate the effects of the alternatives on aquatic, riparian, and meadow ecosystems (FEIS Vol. 2, Chapter 3, part 3.4, pages 227-228). Five of those factors are relevant to changes proposed in the SEIS: (1) reduction in the risk of wildfire; (2) fuel reduction activities including the areas of mechanical fuel reduction and prescribed fire treatments; (3) road management; (4) effects from wildfire recovery and timber salvage; (4) grazing management; and (5) landscape analysis. In addition, while designation of and management within RCAs and CARs are not different between the Alternatives S1 and S2, effects related to RCAs were reevaluated because some assumptions made in the FEIS are no longer valid. Finally, potential effects on impaired waterbodies are also described. Effects of the alternatives on species dependant on aquatic, riparian, and meadow habitats are explained elsewhere in this SEIS (Section 4.3.2).

As described in the FEIS, not all AMS goals are completely addressed by the SNFPA ROD or this proposed decision. For example, water management structures such as dams are considered to influence aquatic ecosystems much more than any other human disturbance in the Sierra Nevada (Kattelmann 1996). Moving conditions toward some of these goals may require changes in how these structures are operated. These are important needs that will be addressed by programs outside the scope of this decision.

However, these other programs will use the AMS goals to provide consistent direction for ecosystem management on national forests in the Sierra Nevada.

Effects Related to Wildfire Risk, Fuels Treatments, Management within Riparian Conservation Areas, Road Management, and Wildfire Recovery and Timber Salvage

The FEIS discusses tradeoffs between potential aquatic ecosystem and water quality impacts from fuel management activities (mechanical treatment and prescribed fire) and risks associated with high severity wildfires (Volume 2, Chapter 3, part 3.4, pages 228-233). Additional discussion of this topic is provided below because these tradeoffs are particularly important and comprehensive evaluations of them have recently been published (e.g., Rieman et al. 2003, Bisson et al. 2003).

Fires can have extraordinary effects on watershed processes and, as a consequence, significantly influence aquatic organisms and the quality of aquatic habitats in many ways (Benda et al. 2003, Rieman et al. 2003, Wondzell and King 2003,). Substantial reductions in riparian shading and altered streamflows can increase stream temperatures to extreme levels (Rieman et al. 2003, McMahon and DeCalista 1990). Flooding, surface erosion, and mass wasting may be increased due to vegetation loss and creation of hydrophobic soils. In turn, dramatic increases in sedimentation, debris flows, and wood inputs may occur. Complete channel reorganization is also possible (MacDonald and Stednick 2003, Benavides-Solorio and MacDonald 2001, Cannon et al. 2001, Meyer et al. 2001, Moody and Martin 2001, Robichaud 2000, Robichaud and Brown 1999, Rieman and Clayton 1997). Several investigators (e.g., Benda 2003, Reeves et al., 1995) have noted that these large, periodic influxes of sediment and wood are a fundamental part of some stream ecosystems and may be important for maintaining suitable spawning gravels and long-term habitat diversity. However, considerable uncertainty remains regarding the role of these massive inputs as well as other short and long-term effects associated with large disturbances such as fire (Benda et al. 2003, Bisson et al. 2003, Dunham et al. 2003).

Because of this uncertainty, differences between the effects of large fires and management intended to mitigate their effects are not well understood. Consequently, with respect to aquatic ecosystems, there are arguments for and against the use of fuels treatments to reduce the extent and severity of future fires (Bisson et al. 2003, Rieman et al. 2003). Some argue that major fire and fuels management efforts may be a threat, rather than a benefit to aquatic ecosystems. Effects of management intended to mimic fire may be significantly different from those associated with fire itself (Rieman et al. 2003, Reeves et al. 1995). Removal of fuels by mechanical thinning, for example, may remove coarse woody material that would structure aquatic habitats in the future. Construction and maintenance of roads and repeated entries into treatment areas may cause chronic effects of lower-intensity, compared to the less-frequent, but higher-intensity effects of fire (Rieman et al. 2003, Rieman and Clayton 1997). These differences could negatively affect species that may be adapted to periodic disturbances, but not chronic ones (Rieman et al. 2003, Poff and Ward 1990).

Others have argued that active management to reduce wildfire risks will be necessary to restore watersheds and aquatic ecosystems (Hessburg and Agee 2003, Williams 1998, Snyder 2001). While these actions pose risks to aquatic resources, they may be far smaller than those associated with large, catastrophic wildfires (Kattelmann 1996). In particular, it is argued that the use of fuels treatments to reduce severe fire potential in former low and mixed-severity fire regime areas, such as low and mid-elevation forests of the Sierra Nevada, could help reduce fire-associated erosion and sedimentation (Hessburg and Agee 2003, Elliot and Miller 2002). Such treatments could have minimal adverse effects on aquatic ecosystems and water quality if they are carefully designed and implemented according to best management practices (BMPs) (MacDonald and Stednick 2003). Furthermore, in heavily roaded and managed watersheds where forests are highly vulnerable, fuels treatments could be beneficial if existing roads could be used and then subsequently removed or upgraded to reestablish hydrologic and biological processes (Bisson et al. 2003).

Roads are a critical component of these tradeoffs, since together with severe wildfires, they often have the greatest effects on aquatic ecosystems and water quality in forested environments. This is true in the Sierra Nevada, with the exception of those areas affected by large water management structures. Roads have effects on geomorphic, hydrologic, and biological processes in aquatic ecosystems and these are summarized below based largely on a recent comprehensive review by Gucinski et al. (2001).

Roads affect geomorphic processes by increasing mass wasting and surface erosion, altering stream channel morphology, extending stream channel networks by modifying surface flows, and causing interactions of water, sediment, and wood at road-stream crossings. Climate, geology, road age, construction practices, and storm history all significantly influence the degree of these effects (Gucinski et al. 2001). Many researchers have shown that roads can deliver more sediment to streams than any other human disturbance in forested environments (MacDonald 2003, MacDonald 2002, Gucinski et al. 2001, Gibbons and Salo 1973; Meehan 1991). In areas where mass wasting is common, forest roads can be especially problematic (Gucinski et al. 2001). In the Sierra Nevada, however, this is not a particularly significant concern because mass wasting hazards are typically low to moderate, with only localized high hazard areas (Kattelmann 1996).

Many studies have shown that surface erosion from roads can be reduced through improved design, construction, and maintenance practices (Gucinski et al. 2001). Operational monitoring by the USFS has shown similar results. For example, 10 years of monitoring different road-related BMPs throughout California demonstrated that they were effective in meeting their onsite water quality objectives (e.g., minimal erosion) at 90% of the 1,072 sites where they had been implemented. Water quality effects of significant magnitude, duration, or extent occurred at only 1% of all 1255 monitored sites (USDA Forest Service, unpublished monitoring data 2003a). Proper road location, drainage, surfacing, and cut slope and fill slope treatments are important in limiting effects. Surfacing materials and vegetative treatments, in particular, have been demonstrated to reduce the amount of fine sediment produced by roads (Gucinski et al. 2001). MacDonald (2002), for example, found that rocked roads in the Central Sierra Nevada produce 10-50% less sediment than native surfaced roads. Others have observed greater reductions, up to 80% or more (Burroughs and King, 1989). Research and monitoring has also demonstrated that a small percentage of roads are often responsible for a large amount of the total road-related erosion and the most harm to fish and fish habitats (Hessburg and Agee 2002, Gucinski et al. 2001, Rice and Lewis 1986). Most road problems during floods result from poor design or construction, particularly at road-stream crossings where streamflow diversions can cause road failures (Gucinski et al. 2001, Furniss et al. 1998, Weaver et al. 1995). Limited information is available regarding long-term, watershed-scale changes to sediment yields associated with road decommissioning and restoration (Gucinski et al. 2001). One recent study by Madej (2001), however, documented that these treatments in Northern California reduced sediment yields from abandoned logging roads by 75%. Monitoring of USFS projects in Northern California indicate that reductions may be significantly higher in some cases (USDA Forest Service, unpublished monitoring data 2003b).

Besides these geomorphic effects, roads affect hydrologic processes. They intercept rainfall on the road surface and cutbanks, and intercept subsurface water moving down adjacent hillslopes. They also concentrate flow and divert water from areas to which it would normally flow. These altered processes modify the amount of time required for water to enter streams (Gucinski et al. 2001). In turn, the timing of peak flows may be changed (King and Tennyson, 1984; Wemple et al. 1996). Studies suggest, however, that the effects of roads on streamflow are generally smaller than the effects of timber harvest.

Wildfire Risk—The treatments in Alternatives S1 and S2 are both predicted to reduce the extent and severity of wildfire over the untreated landscape. However, because it treats more acres using mechanical methods and at higher intensities, Alternative S2 is expected to reduce the extent and severity of wildfire and its effects on aquatic ecosystems to a greater degree than Alternative S1. The total area burned in wildfires under Alternative S2, for example, is projected to decrease from an average of approximately 63,000 acres/year to about 52,000 acres/year during the planning period. In contrast, under Alternative S1 the total area burned annually is projected to increase slightly to an average of approximately 65,000 acres (Figure 4.2.4a). More importantly, from a water quality and aquatic ecosystem perspective, an average of about 5,000 fewer acres are projected to be burned annually by stand replacing events under Alternative S2 than would occur under Alternative S1 (Figure 4.2.4b). The benefits associated with reduced wildfire risk for Alternative S2 are long-term outcomes because substantial differences between the alternatives are not expected to occur for several decades. At the same time, shorter-term risks of adverse effects associated with the fuels treatments themselves are also greater for Alternative S2. These are described below.

Fuels Treatments—Strategically placed area treatments are proposed to limit the extent of wildfire spread and severity under Alternatives S1 and S2. Fuel reduction activities would be accomplished either through prescribed burning, mechanical removal of fuels, or a combination of the two. The alternatives propose differing combinations of fuel management activities, including prescribed fire and mechanical treatments (Table 4.2.4b). Both alternatives emphasize treating fuels in urban areas and high fire hazard and risk areas first.

Potential treatment effects on aquatic, riparian and meadow ecosystems are largely a function of the amounts, types, intensities, and locations of treatments and the standards by which they are implemented. Over next twenty years, Alternative S2 proposes approximately 45% more acres of initial treatments than Alternative S1 (Table 4.2.4b). Approximately 15% fewer acres would be treated with prescribed fire under Alternative S2. In contrast, about 250% more acres would be treated mechanically under Alternative S2. The additional treatment area under Alternative S2 is associated with increased mechanical treatments in the HFQLG pilot project area and complete, rather than partial treatments within treatment areas across the Sierra Nevada. The intensities of the mechanical treatments are also moderately greater under Alternative S2.

As previously described, both Alternatives S1 and S2 include a comprehensive AMS with RCAs that are managed to maintain or restore the structure and function of aquatic, riparian, and meadow ecosystems. Specifically, these areas will be managed to preserve, enhance, and restore habitat for riparian and aquatic-dependent species; ensure that water quality is maintained or restored; enhance habitat conservation for species associated with the transition zone between upslope and riparian areas; and provide greater connectivity with watersheds (ROD, page A-7). Landscape and project-level analysis of environmental effects would be required under Alternatives S1 and S2. As part of these assessments, both of these alternatives require analysis and mitigation to ensure that treatments within RCAs meet riparian conservation objectives, including protection of water quality and aquatic habitats.

The spatial location of strategically-placed area treatments under Alternatives S1 and S2 are the same, but they are different than previously considered. For example, analysis in the FEIS was based on the assumption that the area treatments would be placed primarily on the upper two-thirds of slopes, thus minimizing overlap with RCAs associated with perennial, intermittent, and ephemeral streams. However, this assumption is no longer valid. Consequently, under Alternatives S1 and S2, treatments are not limited to any geographic position. As a result, more treatments within RCAs are expected. Alternative S1 requires that portions of treatment areas be left in an untreated condition. It is likely that riparian areas would be priorities for retention to meet this requirement. Alternative S2 does not require retention of untreated areas within treatment units so that fire behavior and fire effects are effectively reduced within the entire unit. Finally, Alternative S1 limits compaction in RCAs to less than 5% of project activity areas. In contrast, Alternative S2 requires that disturbance within RCAs be evaluated at a watershed-scale as part of project-level analysis. No firm numeric standard is proposed, thus allowing for site-specific evaluations.

Projects under Alternatives S1 and S2 will implement BMPs, certified by the State Water Resources Control Board and approved by the U.S. Environmental Protection Agency, to achieve compliance with applicable provisions of water quality control plans adopted by Regional Water Quality Control Boards (RWQCBs). These projects would also be conducted according to new timber harvest waiver policies adopted by RWQCBs. In addition, projects would be conducted according to Soil Quality Standards to minimize effects on soil and its related effects on water quality, including sedimentation.

Prescribed fire effects on aquatic ecosystems and water quality do not differ substantially between the alternatives because they propose similar treatment areas and the same standards by which these treatments would be implemented. These effects are discussed in the FEIS (pg. 230). In general, they are a function of the spatial patterns of the burn and burn severity, which is affected by weather conditions, fuel moisture, and other factors. Several investigators (e.g., Loomis et al. 2003, Elliot and Miller 2002, Wohlgemuth et al. 1999) have observed that prescribed fires of low intensity that are conducted in accordance with BMPs and retain sufficient post-burn ground cover will likely result in limited effects on aquatic ecosystems, especially when compared to high severity wildfire. Results of USFS BMP effectiveness monitoring for prescribed fires throughout California are consistent with these observations (USDA Forest Service, unpublished monitoring data 2003a). For example, BMPs were effective in meeting onsite water quality protection objectives at 98% of the 196 sites throughout California where these BMPs had been implemented. Of all 254 monitored sites, only one had effects of significant magnitude, duration, or extent (USDA Forest Service, unpublished monitoring data 2003a).

Mechanical treatments involve soil disturbance and biomass removal and consequently may result in increased erosion and sedimentation, runoff, water temperatures, and altered inputs of woody debris to stream channels. The risk of altered soil conditions (e.g., compaction) and accelerated erosion from mechanical fuel reduction treatments varies depending on factors such as methods of treatment, types of equipment used, amounts and types of materials being yarded or piled, soil types, soil moisture conditions, slope steepness, and history of past disturbance. The primary potential sources for sediment are skid trails, landings, and treatment areas near watercourses. These risks are moderately higher under Alternative S2 because of the higher intensity treatments and the probable need for more skid trails, landings, and other possible sources of sediment. Sedimentation risks associated with treatments under Alternatives S1 and S2 may also be greater than those described for Modified Alternative 8 in the FEIS, because these treatments are no longer assumed to occur primarily on the upper two-thirds of slopes. However, since treatments within RCAs would be consistent with RCOs and related Standards and Guidelines, these risks are greatly reduced. For example, based on a project-specific RCO analysis, fuels prescriptions and the methods used to implement those prescriptions may be less intensive within RCAs than on the rest of the landscape. This is especially true in the areas of the RCAs closest to watercourses. Furthermore, under both alternatives, sediment sources would be minimized by application of Soil Quality Standards and BMPs, which have been shown to be effective at monitoring sites throughout California. For example, timber and vegetation management BMPs were effective in meeting onsite water quality objectives at 93% of the 1222 sites where they were implemented. Effects of significant magnitude, duration, or extent occurred at less than 1% of all 1405 monitored sites (USDA Forest Service, unpublished monitoring data 2003a).

Possible effects of the mechanical fuels treatments on runoff are a largely function of the amount of canopy removal over a given time period and the spatial scale of interest. Because Alternative S2 proposes treatments of higher intensity, the risk of hydrologic effects is moderately higher than those for Alternative S1. However, since treatments under both of these alternatives involve forest thinning rather than whole canopy removal, these effects are expected to be relatively small. For example, in the HFQLG area, annual increases are expected to be less than 0.5%. The greatest seasonal increases would occur in summer, but these are a relatively small 0.7% (Huff et al. 2002). Landscape and project analysis would be used to further evaluate and mitigate possible hydrologic effects on a local scale.

A supply of coarse woody debris (CWD) is important for stabilizing stream channels and providing cover for fish. Potential treatment effects on CWD loading to streams are largely related to the amount and sizes of trees removed from RCAs. Depending on the situation, fuels treatments that selectively thinned RCAs could have no effects, positive effects such as a reduction in excessive CWD loading, or negative effects caused by a potential undersupply of CWD (Belt et al. 1992). Assessment of these effects is difficult at the bioregional scale due to extreme variability in the condition of RCAs and the relative importance of CWD in maintaining stream channel structure and function. Consequently, landscape and project-level analysis will be used to assess these effects in detail based on stream width, tree heights, distances from streams, slope steepness, and other relevant factors. Because Alternatives S1 and S2 do not limit treatments to the upper two-thirds of slopes, the risks of CWD-related effects under these alternatives are slightly greater than those described in the FEIS for Modified Alternative 8. Those associated with Alternative S2 are greater than those for Alternative S1 because of the possible higher intensity treatments. However, because projects will meet RCOs under Alternatives S1 and S2, effects on aquatic ecosystems and water quality do not vary significantly between them and should be of limited magnitude, duration, and extent.

Removing vegetation from RCAs may reduce canopy cover, which in turn may affect stream temperature, primary productivity, fish habitat, and riparian microclimate. For example, loss of riparian vegetation may result in larger daily temperature variations and elevated monthly and annual temperatures (Brown and Krygier 1970). Similar to CWD, assessment of temperature effects associated with fuels treatments across the Sierra Nevada is problematic due to highly variable conditions. Alternatives S1 and S2 pose slightly higher risks of temperature-related effects than those described for Modified Alternative 8 in the FEIS. Risks for Alternative S2 are slightly higher than those for Alternative S1 because treatments may be more intensive. However, under both Alternatives S1 and S2 temperature-related effects on aquatic ecosystems and water quality are expected to be of limited magnitude, duration, and extent because landscape and project analysis will be used to ensure that these treatments meet RCOs.

Roads—As with all the alternatives considered in the FEIS, road management does not vary substantially between Alternatives S1 and S2 (Table 4.4.3a). Under both alternatives, the geomorphic, hydrologic, and biological effects of roads, as previously described, would be reduced across the bioregion, although by relatively modest amounts. These reduced effects would primarily result from a net reduction in road miles, reduction of road miles near streams, and reconstruction of existing roads to meet modern road standards. All road construction, reconstruction, maintenance, and decommissioning activities would be conducted according to BMPs. These BMPs, designed and applied on a project-specific basis, would be used to limit effects on aquatic ecosystems and achieve compliance with applicable provisions of water quality control plans.

Under both Alternatives S1 and S2, a reduction in net road miles across the bioregion would result from more road decommissioning than new road construction. Alternative S1, for example, proposes to decommission 950 miles of road over the next decade, while only 25 miles of new road are proposed. This represents a net decrease of approximately 3% of the current 30,098 miles of classified and unclassified roads on National Forests in the Sierra Nevada. Under Alternative S2, 1175 miles would be decommissioned and 115 miles of new road would be constructed. This would result in a net decrease of 3.5% of existing roads across the Sierra Nevada forests. Net road miles are lower under this alternative due to full implementation of the HFQLG pilot project, which includes a substantial amount of road decommissioning (USDA Forest Service, Pacific Southwest Region 1999). Under Alternatives S1 and S2, landscape and roads analysis would be used to prioritize road decommissioning and upgrades.

Almost twice as many miles of roads would be reconstructed under Alternative S2 than S1. This would primarily result from full implementation of the HFQLG pilot project, which proposed substantial amounts of road reconstruction (USDA Forest Service, Pacific Southwest Region 1999). Road reconstruction can have short-term (months to a year or more) adverse effects such as accelerated erosion. However, many road reconstruction projects are undertaken to improve water quality and aquatic habitat over the longer term (years to decades), through improvements such as rocking, surface drainage such as outsloping, and stream crossing improvements to reduce sedimentation risks associated with failures and to improve passage for aquatic organisms. Such improvements are expected to reduce the road related effects previously described.

Wildfire Recovery and Timber Salvage —The tradeoffs of salvage logging following catastrophic wildfire were addressed in the FEIS. Risks were evaluated by the likelihood of wildfire salvage and recovery, which was related to the risk of wildfire, and by the extent and types of treatments possible within wildfire areas. As described above, the extent of wildfire under Alternative S1 is expected to be greater than that under Alternative S2. Consequently, the possibility for salvage logging under that alternative is commensurately greater.

Tradeoffs pertaining to the potential benefits and adverse aquatic ecosystem and water quality-related effects of postfire salvage logging were described in the FEIS and are further described below. There is considerable controversy regarding these tradeoffs and limited scientific information upon which to evaluate them (McIver and Starr 2001).

Benefits of postfire logging may include a reduction of fuels for future fires and a lowered probability that insect pests will infest adjacent green tree stands. In some cases, logging residue can decrease erosion in postfire logged sites by impeding overland flow (Shakesby et al. 1996). Ground disturbance caused by postfire logging can disrupt water-repellent layers, thereby increasing infiltration and decreasing overland flow and sediment transport to streams (McIver and Starr 2001).

Potential adverse effects may include soil compaction and displacement and reduced inputs of CWD, which can alter stream structure and fish habitat. Most studies show that, like in unburned watersheds, erosion risks associated with postfire logging increase with increased road building, use of ground-based logging systems, steep slopes, and sensitive soils. Road-building is likely to cause the greatest increase in sediment transport off-site (McIver and Starr 2001). Some studies suggest that proper recovery and rehabilitation techniques (e.g., correct equipment, logging systems, and other BMPs) may mitigate soil loss and erosion associated with postfire logging (Simon et al. 1994). Aerial logging and logging over snow, use of grabbing systems rather than skidding for log retrieval, and minimization of site entry are particularly effective (McIver and Starr 2001).

Alternative S1 includes restrictions on certain areas following wildfires. At least 10 percent of the total stand-replacement area must remain unsalvaged to provide for wildlife and ecosystem needs. Salvage in old forest emphasis areas and spotted owl home range core areas would only occur to the extent that it would benefit landscape conditions for old forest structure and function. Alternative S2 does not have the area restrictions of Alternative S1, but provides direction to design post-fire restoration projects to reduce potential soil erosion and loss of soil productivity, protect and maintain critical wildlife habitat, and manage the development of fuel profiles over time. Determinations of the extent and intensity of wildfire salvage will be made at the local level based upon site-specific analysis under this alternative. It is likely that more acres in old forest emphasis areas and spotted owl home range core areas will have some level of salvage under Alternative S2 than in Alternative S1 due to the lack of specific area limitations.

Alternatives S1 and S2 anticipate the need for restoration through burned area emergency rehabilitation projects and timber salvage. Where landscape/watershed analysis has been completed, identified desired conditions would be considered as activities are planned. Implementation and effectiveness monitoring would evaluate the efficacy of these treatments, and to improve knowledge for future projects.

Salvage related to insect and disease mortality and other forest events, such as blowdown, and general treatment for forest health was not specifically addressed in the FEIS analysis for aquatic resources. Alternative S1 does not specifically address salvage or forest health treatments not related to stand-replacing wildfire. It is assumed that in this alternative, treatment opportunities would depend upon the desired conditions within the underlying land allocations, snag and down log requirements and area limitation requirements of those land allocations and upon direction in the forest land and resource management plan. Alternative S2 allows consideration of salvage and forest health for a variety of reasons, including recovery of value and support of fuels hazard reduction objectives. As with Alternative S1, Alternative S2 relies on local analysis to determine the extent and intensity of these types of treatments.

Depending on the situation, the types of effects would be similar to those described for fuels treatments and/or wildfire salvage with the exception that these treatments and their associated effects have the potential to be more broadly distributed across an entire landscape, rather than concentrated as in a wildfire. Treatments to improve forest health would be dependent upon site-specific conditions. The extent and intensity of treatments may be higher in Alternative S2. However, at the bioregional scale, effects associated with non-fire related salvage under Alternatives S1 and S2 are expected to be similar and limited in extent, duration, and magnitude. This results from the fact that only a small amount of treatments are expected, the land allocations and desired conditions do not differ between the alternatives, and both apply the same Aquatic Management Strategy and similar standards.

Effects Related to Livestock Grazing

Alternatives S1 and S2 include the same standards and guidelines for streambank disturbance and browse. Both of these alternatives also have the same numeric standards for plant utilization and stubble height. Alternative S2, however, allows these firm utilization and stubble height standards to be modified under certain conditions. These standards are expected to reduce erosion of meadows and improve aquatic habitat conditions by facilitating the growth of stabilizing vegetation along streams. This should result in the reduction of sediment loading into streams for most flow regimes and may also reduce summer stream temperatures as vegetation along streambanks provides increasing levels of shade. The effects of allowing utilization and stubble height requirements to be altered under Alternative S2 are expected to be limited because these changes would occur only if current practices are resulting in good to excellent range conditions and alternative practices would be rigorously evaluated. Alternatives S1 and S2 both require that existing facilities be evaluated for consistency with RCOs and new facilities be excluded from riparian areas. This should also reduce erosion and sedimentation.

Other differences between Alternatives S1 and S2 relate to certain standards and guidelines for the great gray owl, willow flycatcher and Yosemite toad. In general, the changes proposed in Alternative S2 are designed to meet the intent of the standards and guidelines in Alternative S1, but allow flexibility to design management practices address local conditions. The success of this approach could vary by unit, depending on the effectiveness of the site-specific management practices. However, because monitoring is required under this alternative, potential problems should be identified and corrected relatively quickly. These monitoring requirements combined with the plant utilization, stubble height, streambank disturbance, and browse standards minimizes differences in effects on aquatic, riparian, and meadow ecosystems between the Alternatives S1 and S2.

Landscape Analysis

Alternative S1 requires that landscape analysis be conducted across the bioregion within 5 years. Alternative S2 maintains landscape analysis as an integral component of the AMS, but does not require that it be completed within five years. In addition, CARs are no longer mandated as the priority locations for conducting landscape analysis. It is therefore likely that it will take longer for areas to be evaluated under Alternative S2. This is particularly true for CARs, because other areas may be evaluated before them. Because of these longer timeperiods for landscape analysis, identification of opportunities for moving the landscape towards achieving AMS goals may be delayed. The effects associated with these delays, however, are expected to be limited because funding limitations for implementation of projects identified in landscape analysis exert a much stronger control on the times over which they are implemented.

Effects on Impaired Water Bodies

Surface water in the Sierra Nevada is generally considered to be of excellent quality and suitable for almost any use because it contains lower amounts of contaminants than specified in state and federal standards (Kattlelmann 1996). This generality is true of waters on national forests in the Sierra Nevada as well. For example, based on the 2002 list of impaired waterbodies (SWRCB 2002), only about 4% of the more than 12,000 miles of perennial streams on national forests in the Sierra Nevada do not meet water quality standards. Most of these occur on the eastern slope of the Sierra Nevada, including the Lake Tahoe Basin and Owens Valley. Only about 1% of these streams are impaired due to activities that are commonly conducted on national forests (e.g., silviculture, grazing).

Section 303d of the Clean Water Act requires the development of Total Maximum Daily Loads (TMDLs) for all impaired waterbodies. Direction pertaining to TMDLs is the same for Alternatives S1 and S2. Specifically, both alternatives require USFS participation in the development of TMDLs and generation and execution of applicable components of the TMDL Implementation Plans created to restore water quality. Consequently, the alternatives perform similarly with respect to impaired waterbodies. The primary differences between them pertain to the short and long-term tradeoffs of more intensive fuels treatments and risk of wildfire, as previously described.

Summary of Effects to Aquatic, Riparian and Meadow Ecosystems

The FEIS determined that the greatest effects on the landscape would be associated with either mechanical fuel treatments or catastrophic wildfires. Both Alternatives S1 and S2 are expected to perform similarly to the Modified 8 Alternative from the FEIS, which was determined to best protect the values associated with aquatic and riparian habitats. A primary difference between the analysis in the FEIS and the SEIS is related to the changed spatial distribution of strategically-placed area treatments rather than differences between Alternatives S1 and S2. Both alternatives may pose slightly higher risks to aquatic and riparian resources than considered in the FEIS for Modified Alternative 8, because treatments are no longer assumed to occur primarily on the upper two-thirds of slopes. However, these short-term risks may be offset by long-term benefits associated with a greater reduction in wildfire extent and severity. In addition, Alternative S2 may pose higher short-term risks to aquatic resources because it prescribes larger amounts of mechanical treatments and greater treatment intensities. These too, however, are expected to reduce long-term effects associated with wildfire. Short-term risks associated with will be greatly reduced through the application of the same Aquatic Management Strategy with similar standards and guidelines. Specifically, landscape and project-level analysis, attainment of RCOs, implementation of proven BMPs and other standards and guidelines, a modest reduction in overall road miles, and improved road conditions are the most important aspects of reducing risks to aquatic resources.

4.2.4. Fire and Fuels

Factors Used to Assess Environmental Consequences

In this section, alternatives S1 and S2 are compared in the following ways:

- wildland fire acreage burned and severity of effects,
    - treatment effectiveness,
    - economics of fuels treatments, and
    - risk and uncertainty of implementation.

The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 270-306.

Assumptions, Limitations, and Effects of the Alternatives

Projected Wildfire Acreage Burned and Severity of Effects

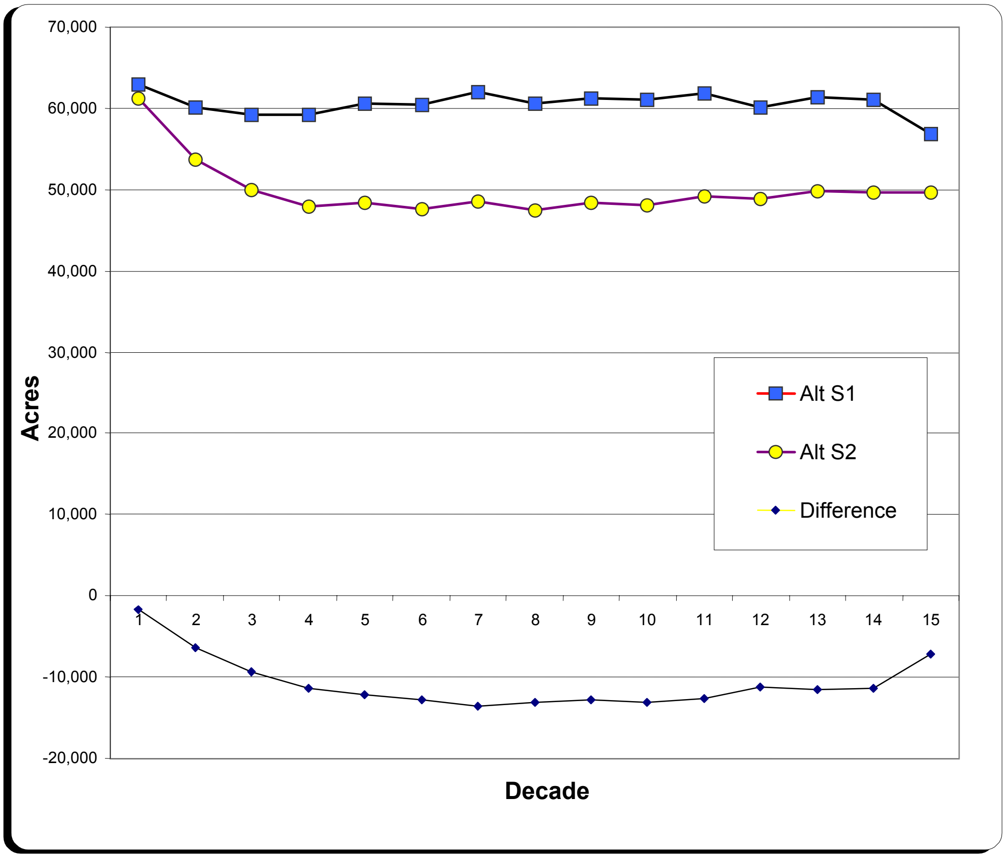
From 1910 through 1980, an average of 43,000 acres per year burned in wildland fires in the Sierra Nevada bioregion. This average, however, does not reflect the episodic nature of large fires.

The projected number of acres likely to be burned annually under each alternative is also an average. Therefore, comparisons between historical averages and model outputs should be framed in terms of increasing or decreasing trends. Significant uncertainty surrounds projections of future wildfire acreage and percentages burned at high severity. In testimony to the House of Representatives, Dr. Thomas Bonnicksen asserted "unnaturally hot wildfires have destroyed vast areas of forest" (Bonnicksen 2003). A fuels review by the Forest Service's Washington Office states "Scientists believe that we have very likely crossed a threshold in forest conditions throughout the West that results in increasingly severe fire behavior. Observations over the past decade indicate an increasing frequency of large and intense fires that support this premise. Over reliance on fire history in the bioregion will lead to an underestimation of wildland fire projections and understate the cost of moving slowly in achieving the fuel management strategy" (Beighley et al. 2003).

Some research has suggested that the pattern and size distribution of fires has changed and are more significant than the total acreage burned. A pre-settlement pattern of burning would involve proportionately more moderately large, low to moderate intensity, well distributed fires. But recent fire trends involve few very large fires contributing a high proportion of the total acreages burned and burned lethally. Before the nineteenth century, the characteristic fires affecting large portions of the landscape would most likely have been of low or low to moderate severity, with patches of higher severity. By the late twentieth century, the characteristic fire was generally of high severity, with only small portions of low to moderate severity. Those forests that have experienced the greatest changes are most likely those on productive sites where fires were more frequent in the past (Skinner and Chang 1996). These important considerations about distribution of sizes and patterns of intensity are difficult to quantify. They need to be recalled qualitatively when reviewing discussions about acreage burned and burned lethally.

The following figures are best interpreted by considering differences between projected trends. The projected trends shown in figures 4.2.4a (wildfire acreage burned) and 4.2.4b (wildfire acreage burned lethally) are based on an assumption that the alternatives would be fully implemented at the beginning of the modeling period. These figures suggest that both alternatives would achieve a reduction in acreage of wildland fire. The acreage differences between the alternatives indicate the relative effectiveness of Alternative S2 in changing fire behavior and intensity across the landscape compared to the result from continued implementation of Alternative S1.

Figure 4.2.4a. Projected Annual Wildfire Acreage Under Each Alternative for All Lethality Classes.



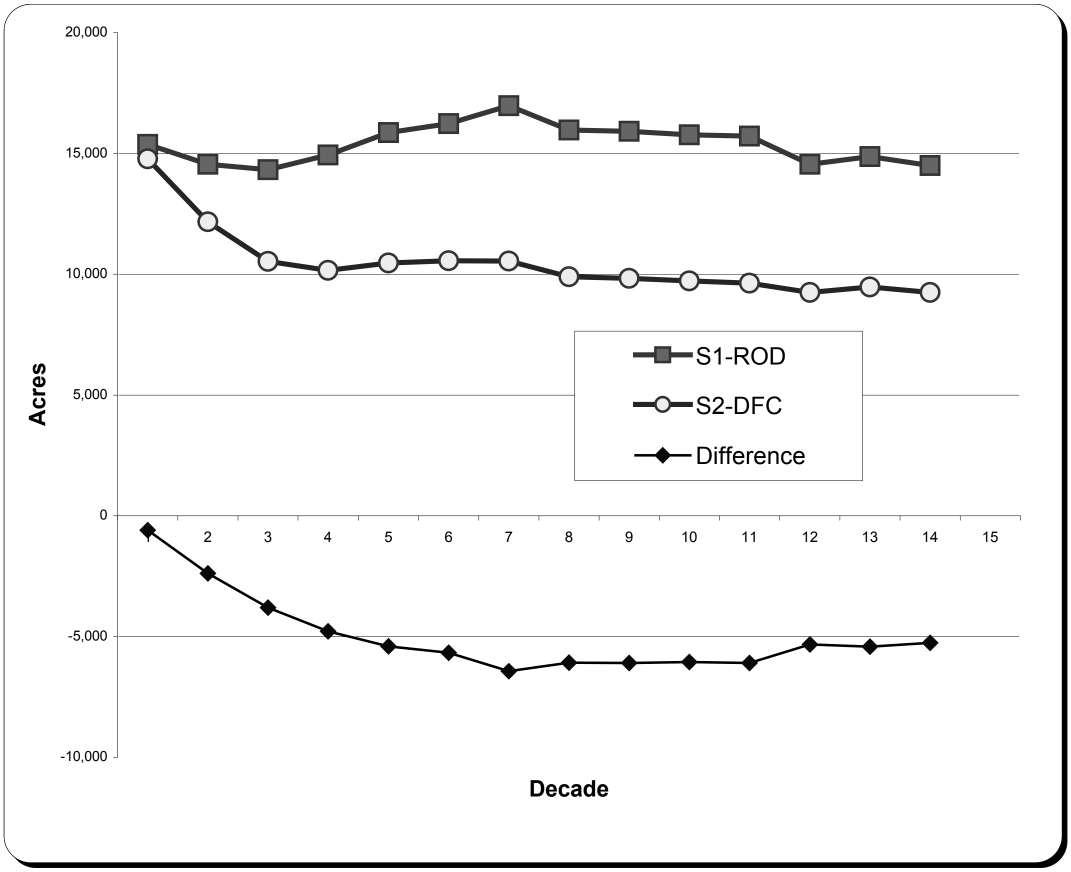
(Source: USDA Forest Service, Pacific Southwest Region 2003d)

Differences in projected wildfire acreages between Alternatives S1 and S2 vary slightly over time. After about 25 years, the differences stabilize at approximately 12,000 fewer acres burned annually under Alternative S2. This analysis suggests that average annual wildfire acreage burned under Alternative S2 would be about 20% less than under Alternative S1.

Fire intensity effects in forested vegetation are characterized using three categories: lethal, mixed-lethal, and non-lethal. In a *non-lethal* fire, only the youngest and smallest trees that are least fire-tolerant are killed. If a fires burn with higher intensity, a mosaic of different mortality levels emerges (*mixed-lethal* fires). Where tree species are fire-adapted or are larger and more resilient to fire, less mortality occurs; other areas may experience higher levels of tree mortality. *Lethal* fires are those that are stand replacing events, where most or all of the vegetation is killed. Lethal fires are also called *high severity* fires, as discussed previously.

Figure 4.2.4b shows the extent of lethality would be less under Alternative S2 compared to Alternative S1. Lethality under both alternatives would be relatively stable through time. The reduction under Alternative S2 would be a result of a combination of overall reduction in wildfire acreage burned and reduction in the percentage of burning that is lethal.

Figure 4.2.4b. Projected Average Annual Wildfire Acreage under each Alternative for Lethal or Stand Replacing Events.



(Source: USDA Forest Service, Pacific Southwest Region 2003d)

Table 4.2.4a summarizes annual acreage of wildland fire that would be characterized as lethal (in forested lands), in the 7th decade following treatments. This time period allows for the full effects of the treatments to be observed. The relative effectiveness of the two alternatives in reducing lethality is demonstrated by these differences. Alternative S2 would result in more than just a reduction in wildfire acreage, but in a reduction in the fraction of wildfire acreage (forested) that is lethally burned.

Table 4.2.4a. Average Annual Acreage of Forested Lands Burned Lethally in the 7th decade of the Planning Period by Alternative.

Alternative	Total Area (ac)	Area Burned Lethally (ac)	Percent Burned Lethally
S1	62,078	16,981	27%
S2	48,572	10,542	22%
Difference	13,506	6,439	

(Source: USDA Forest Service, Pacific Southwest Region 2003h)

Treatment Effectiveness

The National Fire Plan has an objective of reducing acreages in Condition Classes 2 and 3 by moving more of the landscape into Condition Class 1. As shown in the chapter 3 discussion on Condition Class, over 70% of the Forests have lands in Condition Classes 2 and 3. However, treating fuels across that large an area in a reasonable time frame is practically impossible. Aplet and Wilmer (2003) in "The Wildland Fire Challenge" recommended that the National Level condition class maps should not be used for priority setting. They go on to recommend community protection as a focus of fuel treatment efforts. Both S1 and S2 intend to treat aggressively in the WUI. Both of these strategies include locally determined condition class as a factor in deciding where to treat and to assist in prioritization.

Two basic strategies for landscape-level fuel management are to contain fires and to modify landscape level fire behavior. Linear fuelbreaks and DFPZs have been used to help contain fires. These linear treatment areas are intended to provide defensible locations and facilitate suppression action by indirect tactics including backfiring. Undesirable fire effects are assumed to be limited by reducing fire size. This strategy is the approach taken in the HFQLG Pilot Project. By contrast, a *strategically placed area treatment* strategy uses a spatial arrangement of dispersed treatments to modify fire behavior over a larger area. Fire effects and behaviors are modified where the fire encounters the treatment units. The treated areas reduce the overall fire behavior and fire size. Suppression is also facilitated by allowing use of tactics that are facilitated by the collective changes in fire behavior (Finney 2001).

Both of these strategies involve important considerations that can influence effectiveness. The following are three elements to consider in assessing treatment effectiveness (Appendix G FEIS):

- types of treatments,
- acreages treated, and
- location of treatments.

Types of Treatments

The effectiveness of treatments in modifying fire behavior was discussed in the SNFPA FEIS, chapter 3.5, pages 286-288. Additional research and documentation have continued to support the assumption that fire behavior, including intensity, rate of spread, resistance to crown fire initiation and mortality, can be reduced by adequate treatment of the surface fuels, ladder fuels, and tree crown density.

Graham and McCaffrey (2003) report that thinning and similar treatments can substantially influence subsequent fire behavior at the stand level. Depending on intensity, thinning from below and possibly free thinning (removal of trees from all size classes and structural layers) can most effectively alter fire behavior by reducing canopy bulk density, increasing crown base height, and changing species composition to lighter-crowned and fire-adapted species. Crown thinning alone will not reduce crown fire potential in stands with multiple canopy layers and shade-tolerant species (Graham et al. 1999). Graham and McCaffrey (2003) concluded that fuel treatments carried out over large landscapes can reduce the size and severity of wildfires and their effects on communities and the environment.

Omi and Martinson (2002) found that treated stands experience lower fire severity than untreated stands that burn under similar weather and topographic conditions. They examined the suggestion that crown fuel reduction exposes surface fuels to increased solar radiation, which would be expected to lower fuel moisture content and promote production of fine herbaceous fuels. Surface fuels may also be exposed to intensified wind after crown fuel reduction. Prescribed burning may increase nutrient availability and further stimulate growth of fine herbaceous fuels. They concluded that, although surface fire intensity is a critical factor in crown fire initiation, height to live crown; the vertical continuity between strata, is equally important. Furthermore, crown fire propagation is dependent on the abundance and horizontal continuity of canopy fuels. Their research demonstrates that the potential increase in surface fire from canopy reduction is outweighed by the benefit of reduced potential for crown fire.

Stephens (1998) reported on twelve treatments and combinations of treatments to reduce extreme fire behavior. He concluded that the most effective treatments or combinations of treatments for reducing fire behavior in mixed-conifer ecosystems are a) prescribed burning, b) thinning, and biomass removal, followed by prescribed fire and c) salvage or group selection treatments with slash and landscape fuel treatments. These treatments resulted in fuel structures that would not produce extreme fire behavior during 95th percentile weather conditions.

A key observation about Alternative S1 arising from the SNFPA review is the degree to which fuels treatments would be limited to removing trees less than 6-inches dbh. Removing material of this size does not generally result in raising crown base heights to levels that effectively reduce fire intensity and spotting, unless stand structure (of trees >6" dbh) has been treated previously. Treatments on about 30% of the acreage to be treated in the modeled landscape for Alternative S1 were limited to the 6-inch maximum diameter removal prescription (or prescribed burning). Additionally, it was pointed out in letters from Forest Service District Rangers that areas where the 6-inch prescription was required would be avoided, based on cost and inadequacy of treatment. A Washington Office review team concurred with the findings of the SNFPA review (Beighley et al. 2003). It concluded that the imposition of this standard would greatly compromise the effectiveness of mechanical treatments in achieving fuel treatment objectives for treated areas. Treatments limited to the removal of material 6-inches in diameter or less would be ineffective over much of the bioregion. In most cases, a more intensive treatment and/or multiple entries would be necessary to meet fire behavior objectives. As more fuel components are reduced, the treated areas would become more effective in modifying fire behavior.

Alternative S2 allows a full range of treatments to be used to ensure the effectiveness of treated areas.

Acreage Treated

Alternatives S1 and S2 both would involve use of strategically placed area treatments. In addition, the HFQLG pilot project involves a network of linear treatments to modify landscape fire behavior. Alternative S1 and S2 differ with respect to the treated acreage and types of treatments available. Although the original goal of both alternatives was to treat similar acreage, differences in standards and guidelines— i.e. the impracticality of implementing many projects under the standards and guidelines for Alternative S1, result in a significant difference in projections of treated acreage.

Alternative S1 specifies that for mechanical treatments, 10% of the stand area must be left untreated in the defense zone, 15% must remain untreated in the threat zone and 25% must remain untreated in areas outside of the WUI. Additionally, outside the defense zone, 25% of each stand of CWHR types 5M, 5D, and 6, larger than one acre must remain untreated mechanically. Trees up to 12-inches dbh can be removed from the remainder of the treatment area. These requirements would compromise the effectiveness of the treatment areas. Alternative S2 does not require leaving areas untreated.

Alternative S1 requires identification and explicit management of forested patches classified as CWHR types 5M, 5D, and 6 that are 1 acre or larger. These small inclusions are to be managed differently than the stand in which they are found. By defining these forested fragments using CWHR and setting a minimum size of 1 acre, the management direction in the ROD (Alternative S1) relied on parameters that are difficult to use, costly to measure, and subject to inconsistent application among different field units.

Many ecologists consider these small 1-acre old growth fragments, or even clumps of trees, to be functionally important habitat features. However, while these components can be identified, they cannot be classified correctly or consistently on the ground using the CWHR system. This is especially true when the classification of a stands is at or near the bounds of the CWHR class in question. The CWHR vegetation classification system was designed for delineating stands no smaller than 5 acres, rather than for delineating small inclusions within stands. While clumps or cohorts that have the characteristics of large trees can easily be located on photos or on the ground, it is nearly impossible to establish objectively repeatable and verifiably locations of clump boundaries. Even small changes in the location of a boundary can cause a CWHR classification of a stand to change, along with the associated prescription.

These standards that require leaving areas untreated or marginally treated can severely reduce the effectiveness of individual treatment areas in modifying fire behavior. This effect can be seen in the following table (Table 4.2.4b) by comparing the rate of spread, flame lengths, scorch height and projected mortality in typical treated and untreated areas. The untreated areas are very likely to provide for initiation of crown fire or, at a minimum, torching leading to increased spotting. The increased fire behavior in the untreated areas compromises the value of the treated area. Alternative S2 recognizes the value of these patches and encourages their retention where it is consistent with the fuels treatment objectives, but does not require identification and avoiding treatment of these inclusions.

Table 4.2.4b. Comparison of Fire Behavior and Mortality for Treated and Untreated Stands.

Stand Condition	Rate of Spread (ft/hr)	Flame Length (ft)	Scorch Height (ft)	Probability of Mortality (%) by dbh					
				5”	10”	15”	20”	25”	30”
Treated	290	1.8	4	55	25	12	7	4	3
Untreated	977	7.4	79	99	96	90	82	74	66

Note: Estimates obtained from the BEHAVE fire model; the treated condition is based on model 8 l(light ground fuels) and the untreated condition is based on model 10 (moderate timber litter). (Source: USDA Forest Service, Pacific Southwest Region 2003d)

Table 4.2.4c shows approximate annual acreages of initial fuels treatments for each alternative. The increase under Alternative S2 is attributed mechanically treated acres, in group selection in the HFQLG pilot project areas, and reduced emphasis on use of prescribed fire. Under both alternatives, at least one, and most likely two, follow-up or maintenance treatments would be applied to approximately 80% of the treated areas. Maintenance of DFPZs in the HFQLG pilot project area has been included. Outside of the HFQLG area, maintenance treatments are assumed to be accomplished with prescribed fire.

Location of Treatments

Alternative S1 involves a complex set of standards and guidelines that create an incentive to locate treatments to avoid areas where treatment intensity would be restricted. In addition, in some cases the restriction on the number of PACs that could be entered tends to prevent treatments from being located in the most effective pattern. Alternative S2 includes a restriction on the acreage treated in PACs, which provides the opportunity to include small but strategically important PAC acreages in treatment areas. This flexibility means that Alternative S2 is expected to be more effective in reducing the size and effects of uncharacteristically severe wildland fires. Under Alternative S2, fewer restrictions on lands available for treatment allow managers the greatest flexibility to design projects and treatments that meet desired conditions

Table 4.2.4c. Planned Treatments Assumed in Analyzing the Effects of Alternatives S1 and S2.

Table 4.2.4c: acres scheduled for treatment used in analyzing

	NET ACRES PLANNED FOR TREATMENT - NEXT 20-YEARS		
	S1-FSEIS	S1-FSEIS	S2-FSEIS
INITIAL TREATMENTS ONLY	Planned acres treated	Effected Acres	
HFQLG			
Group Selection	24,000	24,000	**52,200**
DFPZ's	158,100	128,061	**161,000**
Individual Tree Selection [HFQLG only]	0	0	**39,400**
Wildland Urban Intermix			
Acres treated in Defense Zone	304,200	273,780	**296,500**
Acres treated in the Threat Zone	413,300	351,305	**401,000**
Wildlands			
Acres treated outside the Threat Zone	1,097,500	823,125	**1,105,200**
Area Treatment under Pref. Altn GSNM	112,500	91,125	**112,500**
BVFSYU - Forest Plan Updated	28,300	28,300	**28,300**
Non Fuel Treatments			
Plantations	30,000	0	**217,500**
Subtotal - Acres Planned for **"INITIAL"** Treatment			
Total Acres planned for Initial Fuel Treatments	2,137,900	1,719,696	**2,413,600**
Planned Treated Areas burned by Wildfire prior to Treatment	**-149,800**	**-149,800**	**-121,200**
TOTAL - Net Acres Planned for "INITIAL" Treatment	**2,018,100**	**1,569,896**	**2,283,400**
Average Annual Acres of Initial Treatment [over 20-yrs]	100,905	78,495	**114,170**
Treatment of Acres in the First 5-years [annual basis]			**122,175**
Treatment of Acres in the 2nd 5-years [annual basis]			**116,575**
Treatment Acres in second decade [annual basis]			**108,965**
Total Mechanical Treatment including Hand treatment	1,026,900	578,696	**1,444,000**
Total Treatment by Rx Fire	991,200	991,200	**839,400**
FOLLOW-UP TREATMENTS -			
Follow-up to meet Fire DFC's	1,760,600	1,090,100	**1,721,900**
Maintenance of DFPZ's - HFQLG {EIS}	337,200	337,200	**337,200**
Subtotal of Maintenance - Followup	2,097,800	1,720,196	**2,059,100**
TOTAL TREATMENTS	4,115,900	3,290,092	4,342,500
Average Annual Total Treatment	205,795	164,505	**217,125**

Note: For S1, the shaded area indicates the net acres treated after excluding 10-25% of all mechanical treatment acres.

(Source: USDA Forest Service, Pacific Southwest Region 2003h)

Economics of Fuels Treatments

Cost efficiency, as the term is used here, refers to the number of acres that can be treated for any given budget allocation. The efficiency of a given program mix depends on the extent to which direct project costs can be minimized and offset by project revenues. The cost efficiency of a given management alternative depends upon the prescriptions applied, the number of acres treated, the cost per acre, and the revenues generated by the sale of recovered woody materials. Table 4.2.4g below displays acreage treated, sawtimber and biomass volumes, costs, and revenues for Alternatives S1 and S2. Treated acres include prescribed burning, mechanical and hand treatments, and the follow-up maintenance treatments.

Treatment costs were estimated on a per acre basis and differentiated by slope and location. Costs were determined by reviewing more than 10 years of actual cost data, as listed in the Pacific Southwest Region's Stand Record System (SRS) database and by surveying three Forest Service contracting officers working on forests the north, central and southern Sierra Nevada. The unit costs used in this analysis are shown in Table 4.2.4e.

Table 4.2.4d. Average Unit Cost by Treatment.

Treatment Activity	Slope %	Cost/Acre
Prescribed Fire in Woody Shrubs	>35	$145
	<35	$125
Mechanical Treatment in Woody Shrubs	>35	$600
	<35	$425
Manual Treatment in Plantations or Non-Stocked Area	>35	$850
	<35	$650
Mechanical Treatment in Plantation or Non-Stocked Area	<35	$375
Release Treatment in Plantation or Non-Stocked Area	All	$600
Precommercial Thinning in Plantation or Non-Stocked Area	All	$300
Reforestation in Plantation or Non-Stocked Area	All	$500
Manual Treatment in Conifer or Hardwood Vegetation	>35	$1,150
	<35	$950
Prescribed Fire Treatment in Conifer or Hardwood Vegetation	>35	$145
	<35	$115
Mechanical Treatment in Conifer or Hardwood Vegetation	>35	$700
	<35	$450
Group Selection in Conifer Vegetation	>35	$425
	<35	$375
Follow-up Prescribed Fire Treatment	>35	$130
	<35	$100
Follow-up Mechanical Treatment	>35	$400
	<35	$250
Maintenance by Prescribed Fire	>35	$130
	<35	$100
Maintenance by Mechanical Methods	>35	$575
	<35	$375

The wood by-products from fuels treatments include both biomass and merchantable timber. Biomass values were taken from reports filed by the California State Board of Equalization. Values for merchantable material are based on a three-year sample of Sierra Nevada national forest TSCs. The sample included 26 contracts, mostly thinning by tractor projects. The data indicates that higher bids are received when higher volumes of sawtimber per acre are offered. In general, tractor logging contracts begin to increase in value when volumes greater than 3 thousand board feet (mbf) per acre are offered. Helicopter logging contracts appear to require volumes greater than 10 mbf per acre. The relationship between volume per acre and bid value was factored into the estimated by-product values (Table 4.2.4.f).

Table 4.2.4.e. Estimated Value of By-Products from Fuels Treatments.

Biomass Values ($/BDT)	
Lassen	$18.00
Plumas	$15.00
Tahoe (Sierraville District)	$15.00
Modoc	$10.00
Tahoe (exc. Sierraville District)	$8.00
Eldorado	$8.00
Stanislaus	$8.00
Other	$0.00
Sawtimber Values by Volume Class ($/mbf)	
<1.0 mbf/ac	$17.50
1-2.5 mbf/ac	$37.50
2.5-6-mbf	$115.00
6-10-mbf	$200.00

Other cost considerations include road construction and reconstruction (see section 4.4.3 for assumptions about activity levels). The costs for road construction ($93,000/mile) and reconstruction ($38,000/mile) used in this analysis are based on the costs reported in the FEIS (volume 2, chapter 3, page 447).

For the two-decade period analyzed, Alternative S2 would involve treatment activities, including follow-up and maintenance on more acres than Alternative S1. Based on these higher activity levels, Alternative S2 is projected to cost roughly $10 million more to implement each year for the first two decades. Alternative S2 is also projected to have higher road costs during the first decade, due to the greater level of activity associated with HFQLG pilot project under this alternative. Note that cost estimates for Alternative S1 are based on the extensive use of prescribed fire (the lowest cost treatment options) in old forest emphasis areas. If burn levels cannot be achieved in implementation, direct project costs are likely to be closer to those projected for Alternative S2.

Alternative S2 offers significant potential for revenue generation from wood by-products. Projected revenue under this alternative averages nearly $80 million per year in the first decade and $33 million per year in the second decade. This compares with roughly $23 million and $9 million projected for Alternative S1 for the first and second decades, respectively.

As shown in Table 4.2.4g, based on the assumptions above, Alternative S2 would generate more than enough revenue to fully cover the direct costs of fuel treatments, road construction, and reconstruction. Alternative S1 would cover roughly half the projected treatment and road costs. The ratio of revenues to costs for the first decade is 0.52 for Alternative S1 and 1.38 for Alternative S2.

Note that the figures reported here do not equate to the total budget or cost of the region's fuels reduction program. Additional program expenditures include planning and analysis, overhead, and project administration. These fixed costs must also be covered by appropriated funds and have not been factored into the analysis above.

Table 4.2.4f. Selected Outputs, Costs, and Revenues for Alternatives S1 and S2.

	Decade 1	Decade 2
S1 – Total Acres Treated	975,992	1,042,149
S2 – Total Acres Treated	1,164,083	1,119,296
Difference	188,091	77,147
S1 – MBF Green Timber Volume	699,533	204,723
S2 – MBF Green Timber Volume	3,294,382	1,318,705
Difference	2,594,849	1,113,982
S1- Tons Biomass (thousands)	4,385	3,980
S2- Tons Biomass (thousands)	7,021	5,948
Difference	2,626	1,968
S1 – Direct Project Costs (M$)	$417,030	$449,590
S2 – Direct Project Costs (M$)	$507,420	$556,600
Difference	$90,390	$107,010
S1 – Road Costs (M$)	$27,215	$18,875
S2 – Road Costs (M$)	$68,455	$18,875
Difference	$41,240	$0
S1 – Total Potential Revenue (M$)	$231,520	$95,670
S2 – Total Potential Revenue (M$)	$795,930	$333,640
Difference	$564,410	$256,236
S1 - Ratio of Revenue to Costs	0.52	0.20
S2 - Ratio of Revenues to Costs	1.38	0.58

(Source: USDA Forest Service, Pacific Southwest Region 2003h)

The assessment above is based on aggregate statistics for the bioregion. The actual opportunity to offset treatments costs with product values can only be determined at a project level and the figures reported above should be viewed as very rough estimates. The forests of the Sierra Nevada show great variability in terms of the potential revenue generated from the by-products of fuels treatments. Table 4.2.4h compares potential revenue generation from fuels treatments for individual forests, based on the cost and value assumptions described above (excluding roads). Under both Alternative S1 and S2, the forests included in the HFQLG pilot project area have the greatest potential for generating revenue to offset the costs of fuels treatments. Alternative S2 greatly increases the by-product value that can be derived from most forests in the bioregion.

Table 4.2.4g. Estimated Average Annual Revenue from Fuels Treatments (1st Decade, $1,000).

	S1	**S2**
Big Valley Sustained Yield Unit	$2,342	$2,342
Giant Sequoia National Monument	$1,212	$1,212
Eldorado	$1,222	$6,761
Humboldt-Toiyabe	$484	$694
Inyo	$518	$1,047
Lassen	$5,710	$18,287
Modoc	$342	$1,527
Plumas	$6,979	$27,757
Sequoia (exc. GSNM)	$297	$1,478
Sierra (exc. GSNM)	$926	$4,698
Stanislaus	$931	$7,164
Tahoe (exc. Sierraville District)	$1,330	$4,623
Tahoe Sierraville District	$184	$1,325
Lake Tahoe Basin Mgt. Unit	$674	$681

(Source: USDA Forest Service, Pacific Southwest Region 2003h)

Risk and Uncertainty of Implementation

Each alternative involves a degree of risk and uncertainty. The risk of loss from wildfires is one of the most important uncertainties to consider. Even though the location and timing of future wildfires cannot be predicted, historical fire frequency and burned acreages are very unlikely to trend downward. Most of the uncertainty is about how many more fires will occur in the future, how many of these will be large severe fires, and where they will occur.

Most of the uncertainty in implementing a successful fire management strategy is associated with the Forest Service's capacity to carry out sufficiently intensive fuels treatments in a sufficient number of places to influence fire regimes in intended ways. Both alternatives include applications of strategically placed area treatments as part of the fire and fuels management strategy. However, the certainty of being able to implement this approach differs by alternative.

Alternative S1 has the highest degree of uncertainty associated with implementing treatments across broad landscapes. As discussed in the *Treatment Effectiveness* section above, several concerns affect implementation of Alternative S1. One general concern is with the specific stand-level structural retention standards in suitable California spotted owl nesting and foraging habitat, which could limit opportunities for effective fuels treatments. Standards and guidelines that most directly affect mechanical fuels treatment include

- limits on the amount of area that can be disturbed by mechanical treatments in any given stand,
- direction to identify and manage inclusions of large trees, larger than 1 acre, having moderate to dense canopy,
- limits on the diameter of trees that can be removed in each treated stand,
- limits on canopy reduction in each treated stand, and
- canopy retention requirements for treated stands (USDA Forest Service, Pacific Southwest Region 2003g; page 23).

The diameter-limit requirement discussed previously in this section results in retaining trees with diameters greater than 6-inches dbh in many areas. Removing only material smaller than this size does not generally result in raising crown base heights to levels that effectively reduce crown fire initiation and individual tree torching.

Another concern is the restriction on treatment of PACs in defense and threat zones. Alternative S1 has a standard and guideline that limits the number of PACs to be treated to 10% per decade. However, an analysis of the potential intersection of the PACs with treatment areas shows that more than 16% of PACs would be intersected by WUI treatments alone. If the standard and guideline, as suggested in alternative S2, were based on acreage, all PAC intersections in the WUI (4% of the PACs by acres) could be treated. This concern is most important if treating the WUI in the first decade continues to the priority for implementation.

These factors, both singly and in combination, mean that both likely treated acreage and the effectiveness of treatments under Alternative S1 would be considerably less than assumed by the SNFPA ROD.

Some uncertainty accompanies the use of mechanical treatments as a surrogate for fire in reducing fuels. The Joint Fire Science Project is studying this uncertainty to help improve understanding about mechanical treatments versus fire as a fuel-regulating process (Weatherspoon and Skinner 2002). Given the same initial stand and fuel conditions, moving toward different desired conditions using only fire would be a much less precise process than using silvicultural cuttings, and it would require a number of follow-up burns for maintenance of fuel treatments. Some desired changes in stand structure—e.g. a thinning of relatively large trees— may not be feasible without doing excessive damage to the overall stand. However, some ecosystem components or processes may be lost by using mechanical treatments rather than fire.

Another element of uncertainty revolves around the ability of the treated areas to reduce rate of fire spread in stands where grasses or other rapidly spreading vegetation is present. This concern has been addressed by Finney (FEIS Appendix G), who observed that even where post-treatment maintenance has not suppressed rate of fire spread to desired levels, fire behavior was generally modified enough that suppression capability, fire intensity, and mortality was significantly reduced in the treated areas.

Standards and guidelines under Alternative S2 would provide managers with the greatest degree of flexibility in establishing and maintaining treated areas and the lowest degree of uncertainty associated with implementing a strategy that relies on strategically placed treatments. This alternative would promote creation of a fuels mosaic that would allow surface fire to only occasionally reach into the base of the crowns in the stand, causing only torching of a single tree or a small group of trees. The distance between crowns of adjacent trees would be sufficient to prevent torching from becoming crowning, where such potential exists.

4.2.5. Noxious Weeds

Measures and Factors Used to Evaluate Alternatives

The same factors used in the FEIS to compare the effects of the alternatives on noxious weed spread and control (FEIS, Vol. 2, Ch. 3, part 3.6, pages 319-320) are used in the SEIS:

- Relative risk of wildfire (wildfire acres projected to burn annually)
- Acres of annual mechanical fuels treatments and placement or pattern of treatments on the landscape
- Acres of annual prescribed fire

Assumptions and Limitations

Forests continue to participate in and work with local cooperative weed management groups. There has been increased public and legislative interest in noxious weeds and invasive species supporting the assumptions made in the FEIS. No additional assumptions or limitations are identified for this analysis.

Effects of the Alternatives on Noxious Weeds

The discussion below focuses on Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 321-322.

Relative risk of wildfire (wildfire acres projected to burn annually)

Alternative S2 is projected to result in fewer annual acres burned by wildfire relative to Alternative S1 by reducing the overall size of individual wildfires. Where treatment areas are effective, the post-fire landscape would likely have more of a mosaic pattern with patches of remnant living trees. Since Alternative S2 generally allows higher intensity treatments, this alternative would likely be more effective at reducing the extent of lethal and high severity fire effects within the treated areas. These remnant patches may help to slow or impede the spread of noxious weeds in the post-fire landscape to the extent that they break stand continuity. Standards and guidelines for addressing weed spread during Burned Area Emergency Rehabilitation efforts should also help to reduce the chance of weed spread after wildfires.

Acres of annual mechanical fuels treatments and placement or pattern of treatments on the landscape

Alternative S2 proposes approximately 21,000 acres per year of additional mechanical treatment over the level proposed for S1. As described in the FEIS, DFPZ treatments pose the greatest risk of noxious weed spread due to their linear and connected nature. Treatments in the WUI also have an increased risk of spreading or creating avenues for spread of existing noxious weed populations. Finally, area treatments pose a lower risk because they are not connected across the landscape. Both alternatives propose the same amount of mechanical fuel treatments in the WUI.

In general, treatment intensity would be higher in Alternative S2, resulting in more open canopies and higher levels of ground disturbance relative to Alternative S1. Alternative S2 may provide a better seedbed and conditions for seed germination and it increases the area where mechanized equipment could be a vector for the spread of noxious weed seeds or plant material. The noxious weed strategy (ROD, Appendix A, page 15) and standards and guidelines for noxious weed management (ROD, Appendix A, pages 30-31) apply to both alternatives. As determined in the FEIS, implementation of these standards and guidelines, in particular the development of noxious weed risk assessments during project planning and follow-up inspection of ground disturbing activities would be expected to reduce the overall risk to a low level.

Annual prescribed burn acres

Projections for prescribed burning are about 50,000 acres per year under Alternative S1 and 42,000 acres per year under Alternative S2. This treatment is likely to occur in units previously treated with either a mechanical treatment or prescribed burning. Repeat prescribed burning is likely to expose patches of mineral soil where down logs and duff is consumed that may be sites for noxious weed inoculation. The extent that mechanized equipment (vehicles, fire equipment, dozers and ATVs) are used in preparation and implementation of the prescribed burn project will affect the risk of noxious weed inoculation. As determined in the FEIS, implementation of the standards and guidelines for noxious weed management, in particular the development of noxious weed risk assessments during project planning and follow-up inspection of ground disturbing activities would be expected to reduce the overall risk to a low level.

Overall assessment of risk

The FEIS ranked alternatives by the overall acreage of initial prescribed burning and mechanical treatment. Re-treatments and maintenance treatments were not considered. Alternatives that treated more acres had higher risk of increasing noxious weed spread. Alternative S2 proposes to treat approximately 13,000 more acres of initial treatment than Alternative S1. Alternative S2 includes a preference to include previously treated stands in locating treatment areas, when possible. This would effectively reduce the acreage of “new” areas treated; however, it would also increase the risk of spread of existing noxious weed infestations that may occur within these areas.

As described in the FEIS, the risk of weed spread in all alternatives will be reduced by following the standards and guidelines for weed management. The higher risk associated with Alternative S2 will be somewhat mitigated by the increased opportunity to survey project areas and treat infested areas.

4.2.6. Air Quality

The air quality analysis presented here focuses on projected PM_{10} emissions under Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 341-354.

For impacts to visibility, ozone, acid deposition, modeling used to predict smoke concentrations in sensitive areas and assumptions used to calculate emissions please refer to the SNFPA FEIS and Appendix H. PM_{10} emissions shown for Modified Alternative 8 in the FEIS and for Alternative S1 in the Draft SEIS are different. The methodology to calculate PM_{10} has not changed. PM_{10} emissions are based on number of acres treated, fuel loading (value being a function of vegetation type and pretreatment), percent combustion and emission factor. Because the values for “number of acres under prescribed fire” and “mechanical treatment” are different under both scenarios (Modified 8 and Alternative S1), the fuel loading is different. This results in different values for PM_{10}. Please see Appendix B SEIS under the heading “Changes in Analysis, Assumptions, and Input Data from FEIS-ROD” for an explanation of the differences between Alternative Modified 8 in the FEIS and the ROD (Alternative S1).

This analysis (for PM_{10} emissions) is limited to and based on numbers of acres affected by prescribed fire, mechanical treatment and wildfire. Analysis also shows the emissions saved from use of alternatives-to-burning like biomass and timber haul.

Table 4.2.6a shows projections for total PM_{10} emissions for each affected national forest from projected wildfires under Alternatives S1 and S2 in the first and second decades.

Table 4.2.6a. Total PM_{10} from Wildfire.

	(Tons)			by		
	First Decade		**Second Decade**		**Total for both Decades**	
	S2-Preferred	**S1-ROD**	**S2-Preferred**	**S1-ROD**	**S2-Preferred**	**S1-ROD**
Eldorado	9,915	10,523	8,303	9,948	18,218	20,471
Inyo	26,222	27,398	26,716	28,099	52,937	55,497
Lassen	27,649	28,910	23,061	27,509	50,709	56,419
Modoc	32,219	34,373	28,833	34,126	61,052	68,499
Plumas	25,875	27,018	21,154	24,982	47,028	52,000
Sequoia	32,540	33,934	28,944	31,352	61,484	65,286
Sierra	25,635	26,635	22,522	25,067	48,157	51,702
Stanislaus	18,749	19,612	15,529	18,409	34,277	38,021
Tahoe	16,517	17,424	13,651	15,816	30,168	33,241
Toiyabe	8,022	8,487	7,314	8,513	15,337	17,000
LTBMU	2,486	2,567	2,279	2,423	4,766	4,991
Total	**225,828**	**236,883**	**198,305**	**226,245**	**424,133**	**463,128**

(Source: Ahuja 2003)

The preferred alternative (S2) provides the greatest protection from wildfire emissions in the second decade. Total PM_{10} produced under Alternative S2 is 424,133 tons versus 463,128 under Alternative S1, a reduction of 38,995 tons over two decades. Historically, it is during wildfire that Federal and State ambient air quality standards violations occur. The Forest Service has acquired several real time air quality monitors and plans to have more as funding becomes available to monitor air quality of wildfires that have potential to cause unhealthy situations. However, wildfires are episodic events and can fluctuate year to year. The data suggests a reduction in public exposure to PM_{10} from wildfires under Alternative S2 compared to Alternative S1 in both decades.

Table 4.2.6b shows prescribed burn PM_{10} emissions. Alternative S2 generates higher emissions because more emphasis on fuels management is planned through increased mechanical treatment and maintenance with prescribed burning. Total PM_{10} produced from prescribed fire under Alternative S2 is 45,989 tons versus 40,311 under Alternative S1. At the programmatic analysis scale of the SEIS, prescribed fire under either Alternative S1 or S2 is not expected to create conditions likely to violate State or Federal standards. This assumption is based on worst-case scenario modeling analysis conducted during EIS development. However, additional air quality analysis will be conducted at the project level using exact metrological and field conditions. Implementation of the air quality standards and guidelines (which are the same under both alternatives) and consistency with new smoke management programs developed by local air pollution control districts (APCDs) under Title 17 guidelines would minimize possibility of smoke intrusions in sensitive areas. Under the preferred alternative more acres are treated mechanically. This is expected to lead to higher emissions initially through burning of slash piles but provides benefits through lower wildfire emissions with less acres burned and reduced build up of hazardous fuels.

Table 4.2.6b. Total PM_{10} from Prescribed Fire*

	(Tons/yr)					
	First Decade		Second Decade		Total for both Decades	
	S2-Proposal	S1-ROD	S2-Proposal	S1-ROD	S2-Proposal	S1-ROD
Eldorado	1340	1141	1406	1628	2747	2769
Inyo	1270	858	1200	920	2470	1778
Lassen	4230	3302	3192	2186	7422	5488
Modoc	2354	1446	2469	1384	4823	2830
Plumas	5266	4740	4423	4769	9689	9509
Sequoia	2198	2040	2337	2506	4534	4545
Sierra	1846	1637	1583	1854	3430	3492
Stanislaus	1944	1690	2126	1829	4069	3519
Tahoe	2582	2215	2176	2491	4758	4706
Toiyabe	519	432	947	415	1466	847
LTBMU	369	339	212	488	581	827
Total	**23,919**	**19,842**	**22,071**	**20,469**	**45,989**	**40,311**

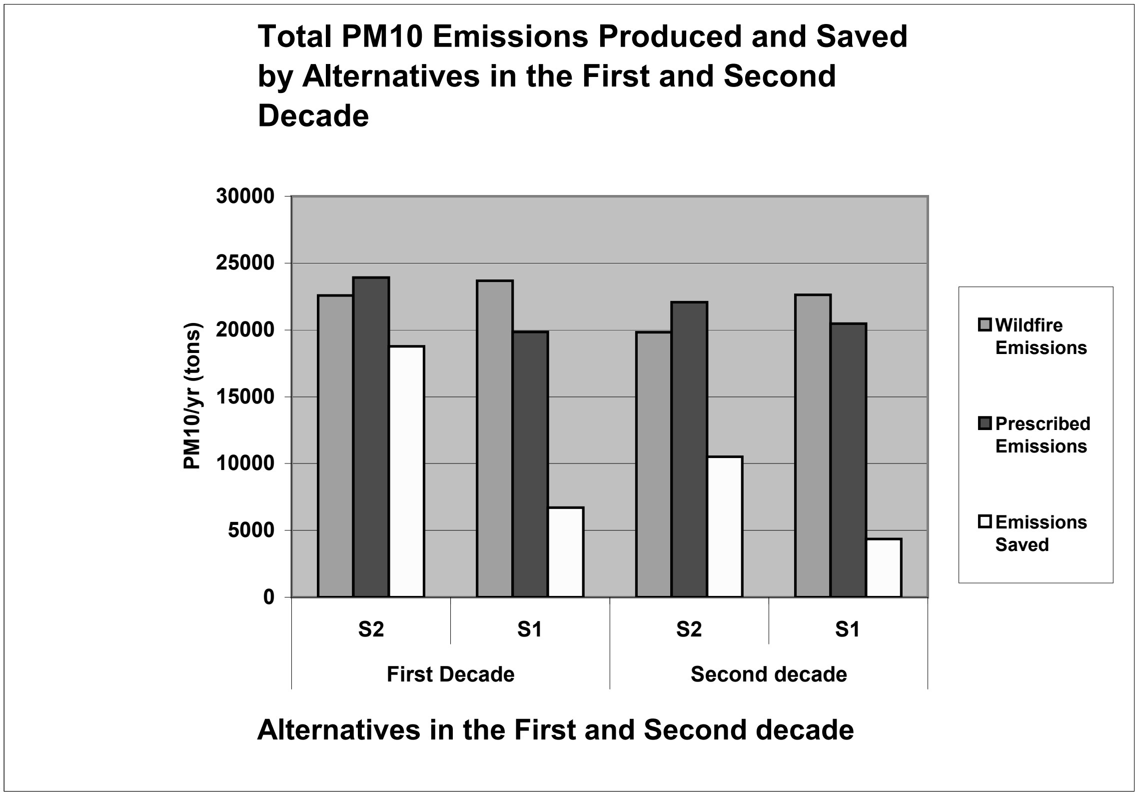
** Includes emissions from pile burns from mechanically treated acres. (Source: Ahuja 2003)*

The FEIS (Vol 1 chapter 2 page 57 under "Smoke Management and Air Quality Protection) states that "the Forest Service would emphasize smoke management and air quality whenever prescribed fire is used. Where feasible and necessary to do so, fuels would be mechanically treated prior to prescribed burning." Under Alternative S2, more acres would be treated mechanically, resulting in lower fuel loadings in treated areas. Prescribed fire or wildfire that followed (as can be seen from the data table 1 Alternative S2 second decade) the treatment would result in lower emissions, thereby protecting public health.

The Forest Service is committed to follow California's Title 17, MOU related to wildland fires with the California Air resources Board (CARB) and the Nevada Smoke Management Plan. These documents provide guidance and direction for smoke management and air quality protection. The CARB and the Forest Service will soon be releasing the Prescribed Fire Incident Reporting System (PFIRS) which will allow air regulators and burners to access planned burning activity and schedule prescribed burning to minimize air quality impacts to the public. Title 17 requires burners to get authorization to burn on the day of burn from APCDs. The APCDs would use PFIRS to contact neighboring regulators (including state of Nevada) before making a "go" decision. These procedures would result in lower smoke impacts to the public and reduce nuisance calls.

Additionally, burners are required to submit burn plans for each project to the APCD under District Smoke Management Programs. A burn plan includes such information as: planned day of ignition, smoke sensitive areas and steps taken to reduce the smoke impacts. Site specific planning and analysis (including public involvement) is conducted at the project level.

Figure 4.2.6c. PM_{10} emissions produced (Wildfire and Prescribed Fire) and saved (Timber Haul and Biomass) in the SNFPA Forests in the First and Second Decade.



(Source: Ahuja 2003)

PM_{10} emissions saved from timber haul and biomass for Alternatives S1 and S2 were calculated and compared with emissions generated from wildfire and prescribed fires. The results are shown in figure 4.2.6c. Alternative S2 in the first decade saves more emissions because of increased timber haul and biomass treatment. The least emission savings occur in Alternative S1 in the second decade.

4.2.7. Soil Quality

Measures and Factors Used to Evaluate Alternatives

- Risks to long-term soil productivity
- Acres of management activity
- Potential effects on soil quality

Assumptions and Limitations

Managing for long-term soil productivity requires balancing the risks of adverse effects from management activities with the risks of high intensity burns.

Effects of the Alternatives

The discussion below focuses on the environmental consequences of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 362-363.

Alternative S2 would involve mechanical treatment of about 21,000 more acres annually than Alternative S1. However, under either alternative, project design and implementation would be required to follow Regional Soil Quality Standards. These standards are designed to protect long-term soil productivity and minimize the effects of soil disturbance and compaction. Both Alternatives S1 and S2 would provide the protection necessary for maintenance of soil quality.

Some adverse effects on soil quality occur as a result of intense wildfires. Alternative S2 is projected to reduce the annual acreage burned by wildfire by 20% in the first 5 decades compared to S1. Alternative S2 is expected to reduce the potential for volatilization of soil nitrogen, loss of soil cover, and subsequent soil erosion due to the reduction in acreage burned by wildfire.

4.3. Species of the Sierra Nevada

Alternatives S1 and S2 include direction to implement recovery plans for federally listed species, as funds allow, and to complete conservation assessments for the following species groups:

- forest carnivores—fisher, marten, and Sierra Nevada red fox;
- high vulnerability plant species;
- aquatic and riparian species—foothill yellow-legged frog, mountain yellow-legged frog, Cascades frog, Yosemite toad, and northern leopard frog; and
- willow flycatcher—all subspecies.

Conservation assessments are reviews of the status of the species which identify activities on the national forest that can affect the species. Conservation assessments are dynamic documents that are updated as substantial new scientific information becomes available. Similarly, ongoing management activities and management direction established in the SEIS ROD will be reviewed and adjusted as needed.

Work on many of these conservation assessments has begun, with some working groups formed and preliminary work accomplished. The conservation assessment for the willow flycatcher has been prepared and is considered in this analysis. However, none of the assessments is fully completed (peer-reviewed and/or published).

This section of the SEIS assesses potential effects of Alternatives S1 and S2 on the species and species groups listed above, based on the most recent scientific information and additional analysis conducted for this final SEIS.

4.3.1. Threatened, Endangered, and Proposed Species

Common Analysis Assumptions and Limitations

The analysis of effects presented in this SEIS supplements the analysis presented in the FEIS (USDA Forest Service 2001b). In addition, the biological assessment for the FEIS (USDA Forest Service 2001b) and for the SEIS (USDA Forest Service 2003a) contain a more thorough analysis of effects and was used in evaluating effects on each species. They are hereby incorporated by reference into this analysis.

For federally listed species, evaluation of permitted land uses and land management proposals using the biological assessment process is described in the Forest Service Manual (Chapter 2670). The biological assessment is designed to determine if implementation of an action or approval of a permit will adversely affect listed species or their critical habitat. Through this process, appropriate management measures are identified to prevent or mitigate adverse effects on the species or its habitat. These site-specific analyses consider local temporal and spatial landscape conditions and specific habitat elements, which cannot be evaluated at a bioregional scale, and include evaluation of effects at the individual and territory scale, where appropriate. If the species or critical habitat may be affected, consultation with the FWS or National Marine Fisheries Service is required. For a particular action, those agencies issue a biological opinion, which can include terms and conditions (required mitigation measures) and/or conservation recommendations (optional mitigation measures). The ESA and FSM 2670 provide specific direction pertaining to compliance with Section 7 of the ESA.

4.3.1.1. California Red-Legged Frog

Factors Used to Assess Environmental Consequences

As described in chapter 3 and in the FEIS, a variety of factors influence California red-legged frog populations and their habitat. Because the Forest Service has no direct control on agricultural and urban development in the species' range, this factor is not discussed further herein except as it contributes to cumulative effects on this species. Forest Service activities relating to dams and diversions, mining, recreation, and chemical toxins would be identical under Alternatives S1 and S2, and the effects of these activities are analyzed in the FEIS. No additional information or analysis of these factors is provided here. Four factors are considered to distinguish effects of the alternatives:

1. Livestock grazing
Measure: potential for direct effects to individuals

2. Prescribed fire
Measure: acreage on which prescribed fire is the primary fuels treatment

3. Vegetation management and mechanical fuel treatments
Measure: protection of riparian areas

4. Roads
Measure: stream crossings and roads in riparian areas

Analysis Assumptions and Limitations

The historical distribution of California red-legged frogs on national forest lands is uncertain. Surveys have been ongoing on most of the forests that are thought to be within the species' historical range. The California red-legged frog has only been documented on the Plumas National Forest. Although there are recent occurrences documented on private land near three national forests within the planning area (Lassen, Eldorado, and Tahoe National Forests), it is unknown if the species extends onto those national forests, which are generally situated at the upper elevation range of the species.

Six critical aquatic refuges (CARs) will be established on the Plumas National Forest in areas of California red-legged frog occurrences (Appendix I of the SNFPA FEIS) following completion of the HFQLG Pilot Project. Portions of the Eldorado and Stanislaus National Forests are within the area originally considered for critical habitat for this species—the designation has since been withdrawn—but no CARs were established as no known populations are known to be present on these forests. If new populations are located, the establishment of a CAR would be considered to protect the sites, because of the limited extent of known populations on the national forests and because of the species' federally listed status.

Since little is known of the species' life history and ecology in the Sierra Nevada bioregion, it is assumed that the species parameters are similar to those applicable to other areas of California (USDI Fish and Wildlife Service 2002a). Of particular uncertainty is the species' dispersal habit in drier forest environments, compared to moister coastally influenced areas, and the effects of cold and freezing winter conditions on behavior and distribution of the species at its upper elevation range. We assume in this analysis, however, that these factors are not limitations on the species' distribution.

Species experts believe that most California red-legged frog populations have been extirpated from the Sierra Nevada (USDI Fish and Wildlife Service 2002a). Most potential habitat, which is defined by elevation range and the presence of permanent water sources, has not been evaluated for suitability and most suitable habitat has not yet been surveyed. Identification and management of potentially suitable habitat adjacent to occupied areas will be important to allow for population expansion which is necessary for recovery of this species. The small number of populations currently on or potentially near the national forests means that potential direct and indirect impacts of Forest Service actions are limited at this time.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.3, pages 29-39.

Livestock Grazing

Potential effects of livestock grazing are direct mortality to adults, eggs, or tadpoles from trampling at water sources. The risk to adults is relatively low and moderate for tadpoles, because they are mobile; it is highest for eggs, which are typically fixed to aquatic vegetation along the edges of water sources.

Changes to standards and guidelines for livestock grazing under Alternative S2 relative to S1 were primarily designed to address issues regarding willow flycatchers and Yosemite toads. Since the willow flycatcher and Yosemite toad generally occur above the 5,000 foot upper elevation range for this species, it is unlikely that these changes in livestock grazing management would affect the California red-legged frog. One modified standard and guideline for livestock grazing would allow local tests of alternative utilization standards, where range is currently in good to excellent condition. In areas where local tests of these herbaceous utilization standards are implemented, it is possible that the timing or intensity of livestock grazing would change, which could result in either higher intensity grazing over a shorter time frame or lower intensity grazing over a longer time frame. These and other options for livestock grazing might increase risks of trampling to individuals if livestock enter riparian areas or suitable water sources. Development of these local tests would require an evaluation of effects to this species, and, where effects are anticipated, consultation with the FWS would be required. In general, the effects of livestock grazing on this species are expected to be similar for Alternative S2 as for Alternative S1 because of the limited differences between the alternatives. These effects are more fully described in the SNFPA FEIS (volume 3, chapter 3, part 4.4, page 209).

Additional effects to this species could result from livestock damage to streambanks and edges of water sources. Both alternatives include the same standards and guidelines that provide protection and management of riparian areas, which would prevent, minimize, or mitigate these potential effects.

Prescribed Fire

Both alternatives include a standard and guideline to prevent prescribed fires from being ignited in riparian areas. The intent is to minimize damage or loss of riparian vegetation because prescribed fire backing downslope into riparian areas would burn under lower intensities than fires that were ignited in the bottom of riparian areas and allowed to burn upslope. In general, prescribed burning has the potential to remove coarse woody debris and surface material that may be used for shelter by dispersing individual frogs. The loss of coarse woody debris is especially likely where surface fuel levels are high. Where prescribed fire is used as a follow-up treatment to a mechanical fuels treatment, i.e. where surface fuel levels have been reduced, retention of coarse woody debris is more likely. Prescribed burning in the fall is also more likely to result in loss of coarse woody debris, because fuel moisture levels are low and material is more easily consumed. This loss of coarse woody debris could expose individuals dispersing in the spring or fall to desiccation or predation, if other shelter features (rodent burrows, rocks, crevices under trees and stumps, etc.) are lacking.

Alternative S1 would involve more use of prescribed fire as the primary fuels reduction method, since it is the preferred treatment type in several areas. Alternative S2 would allow mechanical treatments in many of these same areas, where equipment use is suitable (generally on slopes less than 35% with road access). The effects of equipment use on the species are described under “Vegetation Management and

Mechanical Fuel Treatments” below. To the extent that Alternative S1 includes more fall prescribed burning, it could result in more consumption of coarse woody debris through burning than Alternative S2, particularly following repeated maintenance burns.

Direct effects from prescribed burning are expected to be minimal, since burning would typically not be done when the ground has surface moisture and frogs are most likely to be actively dispersing. However, there is a risk of effects to individual that may be dispersing in the spring or fall following rain events. These risks would be evaluated site-specifically during the planning for individual prescribed burn projects based upon the proximity to known or potentially occupied sites. Indirect effects from preparing projects for prescribed burning (e.g. constructing or maintaining firelines) could occur, but this risk would also be evaluated site-specifically for each project, based upon the location of the burn unit and the closest known or potential site of occupancy. These preparation activities typically occur during the summer when individual frogs are not likely found away from water sources.

Vegetation Management and Mechanical Fuel Treatments

Mechanical fuels treatments would be performed under both alternatives, but more would be done under Alternative S2. Mechanical equipment would typically be used during the dry season (late spring through late fall), when California red-legged frogs are least likely to be dispersing, resulting in minimal risk of direct mortality from crushing. Equipment use during the dispersal season could result in a slight risk of direct mortality, if dispersing frogs sheltered underneath equipment tires or tracks while equipment was idle. This risk would depend upon the location and distance of equipment to the nearest occupied frog habitat, and this risk would be evaluated in project planning.

Fuels treatments in upland areas would change the microclimate in stands that may be used for dispersal during the spring and fall. How these changes would affect the species’ ability to disperse through treated stands is unknown. The effects would be less pronounced within RCAs because of the direction to design treatments to protect riparian conditions which includes consideration for stream shading. In addition to microclimate changes, thinning within stands may change the visibility of dispersing frogs to predators. The extent of this effect is unknown. In other areas of California, the species appears to disperse through open canopied areas (coastal rangeland), but the species’ requirements for dispersal habitat within Sierra Nevada habitats is unknown.

Both alternatives would involve implementation of same direction for management within aquatic and riparian areas. This direction requires evaluation and mitigation of project effects on erosion, soil quality, and dependent species. The Aquatic Management Strategy (AMS) (see SNFPA ROD, appendix A, page A-5), which includes direction for riparian conservation areas (RCAs), would require management consideration for preserving riparian conditions directly benefiting the California red-legged frog.

Roads

The difference in road construction between Alternatives S1 and S2 is in part based upon the HFQLG Pilot Project. It has been estimated that up to 100 miles of new road construction may be needed in the HFQLG Pilot Project, primarily for access to group selection units. This rate of road construction and its effects were analyzed the HFQLG FEIS. A smaller amount of additional road construction (approximately 15 miles per decade across the bioregion) is projected to be needed outside of the HFQLG area, primarily as extensions of existing roads for access to area treatments for mechanical vegetation treatments. Since the only known current population on national forest land is on the Plumas National Forest, the placement of these roads in relation to occupied and suitable California red-legged frog habitat would be evaluated on a site-specific basis. Mitigation measures to avoid adverse impacts would be incorporated into projects, as a part of project planning or in response to consultation with the FWS. These planning processes result in similar effects of either alternative.

HFQLG Pilot Project

Under both alternatives, the HFQLG Pilot Project will implement direction from the Scientific Analysis Team (SAT) guidelines for protection of riparian areas during the life of the project. Thereafter, direction from the Aquatic Management Strategy (AMS) (see SNFPA ROD, appendix A, page A-5) will apply. The effects of implementing the SAT guidelines have been analyzed and are discussed in the HFQLG FEIS and its biological evaluation as well as in the FEIS and its biological evaluation. The SAT guidelines provide similar levels of protection of riparian vegetation and riparian condition as the AMS; therefore, both alternatives would be expected to provide similar levels of protection of riparian areas where this species may occur.

Within the HFQLG Pilot Project area, CARs will not be explicitly managed until completion of the pilot project. Goals and objectives for these CARs are the same for Alternatives S1 and S2. CAR designation requires consideration of effects of proposed projects on this species.

Cumulative Effects

Under both alternatives a strategic landscape fuels management strategy would be used as a short term to move towards a goal of reducing the size and intensity of wildland fire. For this purpose, fuels on a small percentage of the Sierra Nevada landscape would be directly treated over the short-term (two decades) in a pattern that is essentially the same between alternatives. Alternative S2 is projected to reduce the risk of high intensity wildfire slightly more than would Alternative S1 in the short-term and result in a cumulatively larger reduction over time. The extent that California red-legged frog habitat has been directly impacted from high intensity wildland fire is unknown. However, large, high intensity wildfires can result in significant changes to downstream aquatic systems by increasing sedimentation and reducing water quality. These effects are most pronounced in the short-term following the fire event; however, long-term changes to channel morphology can also result. To the extent that the fuels management strategy under these alternatives is effective, the aquatic systems used by this species will benefit under both alternatives.

Habitat

Under both Alternatives S1 and S2, suitable but isolated habitat patches would persist in low abundance on the national forests. Although some of the subpopulations associated with these environments may be self-sustaining, opportunities for interactions among populations in many of these suitable environmental patches are limited. Both alternatives provide specific direction for management of RCAs, which should assure continued contribution of these patches to potential habitat.

Effects of Alternatives S1 and S2 would differ little and are small relative to the current condition. Both alternatives include measures to protect the species and its habitat at the site-specific project level. CARs will be established for populations of California red-legged frogs within known occupied drainages following completion of the HFQLG Pilot Project. As additional populations are identified, additional CARs can be added to the system. Since this species is a federally listed species, effects of the proposed changes in S2 would likely be negligible, because site-specific analysis, project mitigation, and consultation with the FWS, where necessary, would be carried out. Habitat for California red-legged frog should be maintained or improved through implementation of RCAs. Both alternatives would limit streambank disturbance to 10% of any reach within a CAR and to 20% of any reach in general. Surveys of suitable habitat would be required prior to vegetation treatments under both alternatives.

Relative to Alternative S2, Alternative S1 would include more widespread use of prescribed burning as the primary treatment, which has a higher probability of reducing the amount of coarse woody debris used for sheltering cover by this species. Spring and fall burning periods may overlap with the dispersal period for this species and therefore may adversely affect it. Because the known or suspected distribution of populations on the national forests is small, the risk posed to this species by individual projects is limited and would be evaluated site-specifically and through consultation with the FWS, as needed.

Livestock grazing would be permitted within the range of this species under essentially the same standards and guidelines under both alternatives and would have the same effects discussed in the FEIS.

The intensity and amount of mechanical treatment and resulting potential for habitat alteration in uplands would be slightly greater under Alternative S2 than under Alternative S1 but the overall effects would be similar since the same areas would be proposed for treatment. Alternative S2 is projected to result in a slight reduction in the risk of high intensity wildfire by achieving treatments on more acres in a shorter timeframe than Alternative S1. Given the restrictions on treatment in riparian areas, wildfires generally pose a greater risk to habitat.

Population

The potential distribution of this species is restricted throughout its range. Habitat patches are highly isolated and would support very low potential abundance. Gaps where the likelihood of population occurrence is low or non-existent are large enough that the possibility of interaction between populations is small or nonexistent, the potential for extirpation is strong, and the likelihood of recolonization is small. Although some rare, isolated populations have persisted, the overall range of the species has been significantly reduced from the historical distribution. Both Alternatives S1 and S2 have a very low probability of reversing the trend, because the amount of suitable habitats on the Sierra Nevada national forests is small and the majority of potentially recoverable habitat is off the national forests on private lands.

The California red-legged frog occurs primarily in lower elevation riparian ecosystems (below 5,000 feet and typically below 3,500 feet). Biologists believe that this species has been extirpated from a large portion of its historic range, due principally to water and hydroelectric development, grazing, and urbanization that adversely affect sediment and stream flow regimes, mostly on lands outside of the national forests (in the Central Valley, Sierra Nevada foothills, and the Coast Ranges and its foothills). Suitable habitats for this species are not abundant and are highly isolated or occur in patches on national forests within the planning area. The cumulative effect of continued expansion of human presence within the foothills of the Sierra Nevada, the associated water use patterns, and agricultural activities within the species historic range will continue to limit or reduce populations of this species. These actions are outside of Forest Service control.

4.3.1.2. Least Bell's Vireo

Factors Used to Assess Environmental Consequences

1. Habitat loss and degradation
Measure: protection and improvement of riparian habitats

2. Livestock grazing
Measure: risk of nest parasitism

Analysis Assumptions and Limitations

Detections of this species within the planning area have only been recently documented near the Sequoia National Forest along the South Fork of the Kern River, as incidental observations during willow flycatcher surveys. These detections of singing males may represent site occupancy and indicate that breeding is likely occurring, although this has not been documented. The extent of the population is unknown at this time, but the species could occupy habitat on the national forests. Least Bell's vireo surveys are expected to better delineate the existing population, which is needed to support site-specific project evaluation.

The relationship of human activities—including livestock and pack stock grazing, recreation, and human habitation (in private inholdings and lease tracts)—and brown-headed cowbird distribution in Sierra Nevada ecosystems is not well understood. Other factors affecting brown-headed cowbird distribution, including variations in distribution across the bioregion, are unknown. Information about brown-headed cowbird relationships comes primarily from other areas in the west with only a few studies from the Sierra Nevada. Rates of Least Bell's vireo nest parasitism by brown-headed cowbirds is also not well known for the Sierra Nevada bioregion, but studies in other areas of California suggest that nest parasitism may be a concern in the Sierra Nevada.

Direct/Indirect Effects of the Alternatives

Habitat Loss and Degradation

Both Alternatives S1 and S2 include direction to manage riparian habitats according to the AMS. This strategy includes standards and guidelines designed to protect willows and other riparian plants that are important habitat components for this species.

Alternatives S1 and S2 also provide direction for management of livestock grazing. Alternative S2 includes a standard and guideline allowing local flexibility to deviate from normal utilization levels based upon either a fixed percent utilization or plant stubble height, where range condition is good to excellent. This deviation is allowed to respond to local conditions and to rigorously test and evaluate alternative utilization standards. Given the requirement for rigorous testing and the agency requirements for management of federally listed species, these deviations, if they occur within areas potentially occupied by this species, would be designed to maintain or improve habitat conditions and avoid impacts to this species. Therefore, the effects of this difference between alternatives are believed to be minimal, and neither alternative would adversely affect habitat for this species.

Livestock Grazing - Nest Parasitism

Both Alternatives S1 and S2 include direction to consider modifying locations and operations of livestock and pack stock facilities to reduce the potential for attracting brown-headed cowbirds.

Least Bell's vireos may benefit from management for the willow flycatcher, a similar species, where the two species occur together. Alternative S2 includes changes to the definition of known willow flycatcher sites which reduces the number of sites that would be subjected to late season grazing restrictions compared to Alternative S1. Since the primary intent of grazing season restrictions is to minimize nest disturbance, Alternative S2 identifies sites that have not been occupied in recent years and focuses management on habitat conditions rather than restricting the grazing season. The extent of least Bell's vireo distribution in the Sierra Nevada is unknown and, therefore, the overlap with willow flycatcher distribution is unknown, so the effects of this change are unknown at this time. Neither alternative includes direction for management of livestock grazing specifically for least Bell's vireos. However, evaluation of livestock grazing and identification of measures to minimize or avoid adverse effects to least Bell's vireo is required by agency direction and the ESA. Adjustments would be made in consultation with the FWS and would be developed site specifically.

HFQLG Pilot Project

Although the historic range of this species includes the Sierra Nevada foothills north to Red Bluff, the species is believed to be extirpated from the Sacramento and San Joaquin Valleys and currently persists primarily in southern California. Recent detections near the Sequoia National Forest suggest potential range expansion of the species; however, it is not anticipated that expansion would occur within the

HFQLG Pilot Project area within the timeframe of this plan amendment. The HFQLG Pilot Project will apply the same standards and guidelines for livestock grazing as the rest of the Sierra Nevada national forests. Under both alternatives, the HFQLG Pilot Project will implement direction in the SAT guidelines during the life of the project, and then direction from the AMS will apply. The effects of implementing the SAT guidelines have been analyzed and discussed in the HFQLG FEIS and its biological evaluation, and the effects of implementing the SAT guidelines in lieu of the AMS have been evaluated and discussed in the FEIS and its biological evaluation. The SAT guidelines provide similar levels of protection of riparian vegetation and riparian condition as the AMS; therefore, both alternatives are expected to provide similar levels of protection of riparian areas.

Cumulative Effects

Habitat

Under both Alternatives S1 and S2, suitable but isolated habitat patches for least Bell's vireos would persist in low abundance on the national forests. Although some of the subpopulations associated with these environments may be self-sustaining, opportunities for interactions among populations in many of these suitable habitat patches are limited. Both alternatives provide specific direction for management of RCAs, which should assure continued contribution of these patches to potential habitat.

Both alternatives incorporate the AMS, which requires that projects be designed to maintain and improve riparian conditions, especially where the species is expected to occur. This strategy should allow for the maintenance and recovery of riparian habitat across the bioregion. If the species' range expansion continues, potential habitat in the form of riparian vegetation should be available.

Population

The potential distribution of this species is restricted throughout its range. Habitat patches are highly isolated and would support very low potential abundance. Gaps where the likelihood of population occurrence is low or non-existent are large enough that the possibility of interaction between populations is small or nonexistent, the potential for extirpation is strong, and the likelihood of recolonization is small. Although some rare, isolated populations have persisted, the overall range of the species has been significantly reduced from the historical distribution. Both Alternatives S1 and S2 have a very low probability of reversing the trend, because the amount of suitable habitats on the Sierra Nevada national forests is small. The historic distribution of this species in central and northern California was primarily in the Central Valley and in the Sierra Nevada foothills. The species is not thought to have been common in the majority of the Sierra Nevada national forests and, therefore, not dependent upon them for population viability. Management of riparian habitats, in particular for similar species such as the willow flycatcher, may provide potential habitat for least Bell's vireo to the extent that the two species distributions overlap.

4.3.2. Forest Service Sensitive Species

Common Analysis Assumptions and Limitations for Sensitive Species

For *sensitive species* designated by the Forest Service, evaluation of permitted land uses and land management proposals using the biological evaluation process is described in FSM Chapter 2670. The biological evaluation is designed to determine if approval of a permit or implementation of an action would adversely affect the viability of the species or contribute to a trend toward federal listing under the ESA. These site-specific evaluations consider local temporal and spatial landscape conditions and specific habitat elements that cannot be evaluated at a bioregional scale and include evaluation of effects at the individual and territory scale, where appropriate. Through this process, appropriate management measures are identified to prevent or mitigate adverse effects on the species or its habitat.

The factors and measures used to assess the effects of Alternatives S1 and S2 on these species are the same as those used in the FEIS (see volume 3, chapter 3, part 4.4).

4.3.2.1. Fisher

Factors Used to Assess Environmental Consequences

1. Protection and recruitment of large old trees (conifers and hardwoods)
Measure: large trees

2. Retention of dense forest canopy
Measure: canopy closure

3. Retention and recruitment of large snags
Measure: large snags

4. Retention and recruitment of large down wood
Measure: coarse (large) woody debris

5. Intermix of California black oak and canyon live oak in suitable coniferous habitats
Measure: intermix of California black oak and canyon live oak in suitable coniferous habitats

6. Management of human presence and associated activities
Measures: recreation, roads

7. Distribution and abundance of fishers
Measure: survey requirements and status and trend

8. Management of reproductive sites and protected areas
Measure: protected areas for fishers

9. Quality and quantity of habitat (including connectivity)
Measure: abundance of old forest conditions and connectivity

10. Quality, quantity, and distribution of habitat of prey species
Measure: prey habitat

Analysis Assumptions and Limitations

Any projects proposed to implement the decision will require site-specific analysis in biological evaluations. For fisher, it is important for these analyses to consider temporal and spatial cumulative effects at the home range scale and individual habitat elements (e.g. den trees and den sites) at the individual territory scale.

Analysis of old/mature forest habitat elements is summarized in this discussion. Supporting information showing habitat trends based on modeling for these elements is presented in section 4.3.2.3 for the California spotted owl and in Appendix B and are applicable to the analysis of fisher. Trends in habitat and habitat elements important to fisher are projected over the next 150 years. However, the longer the forecast period, the greater the uncertainty becomes about the reliability of the projections. Information beyond 20 years is provided to only identify general trends.

There is uncertainty regarding the difference in effects of vegetation treatments using prescribed fire versus mechanical equipment. When using prescribed fire, this uncertainty is related to:

- the potential risk of escaped fires leading to loss of fisher and their habitats,
- the ability to protect critical habitat elements such as down logs,
- the ability to maintain high canopy closure and vegetation structure at den sites, and

- the likelihood of applying prescribed fire effectively across the landscape under current air quality constraints of the southern Sierra Nevada and within overall funding constraints.

This uncertainty in regard to retention of habitat elements when using prescribed fire was reflected in the SNFPA ROD guideline to only use mechanical treatment in the Southern Sierra Fisher Conservation Area where possible.

Treatments Outside of the Southern Sierra Fisher Conservation Area

This analysis primarily addresses the Southern Sierra Fisher Conservation Area (SSFCA) because it is the only known occupied habitat in the planning area. Outside of the SSFCA, guidelines applicable to both alternatives allow for fisher dispersal and options for reintroduction in areas of currently suitable, unoccupied habitat. These guidelines and design features provide for:

- retention of a minimum canopy closure of 40%,
- riparian corridors with linkages suitable for wildlife dispersal,
- retention of large trees, including 40% of the existing basal area in westside forest and 30% in eastside forests in the largest size class available,
- recruitment of large trees over time, and
- planned activities that affect approximately 25-30% of the forested landbase.

Treatments prescribed for both alternatives retain suitable foraging and dispersal habitat for fisher, at a minimum, and retain habitat elements that can provide denning habitat within a relatively short time in westside forests. Historic fisher occupancy is limited to westside forest except within a small portion of the Southern Sierra Fisher Conservation Area, thus eastside forests are not addressed in detail for the remainder of the Sierra Nevada bioregion.

Proposed treatments affect approximately 25-30% of the area and occur outside of wilderness and other restricted areas. This results in a landscape with large blocks of untreated habitat potentially suitable for reintroduction of fisher. Outside of the wildland urban interface, treatments can be viewed as small inclusions within a larger untreated watershed and are generally not continuous linear features that would impede fisher movement. The treated areas retain down logs, large hardwoods, large trees, snags, and other features important to fisher such that fisher would be able to use them for foraging. These features would retain the habitat elements most at risk and hardest to create if monitoring shows these habitat assumptions are incorrect and should provide suitable habitat for fisher population expansion. There is some evidence from other introduced fisher populations and from the expansion of the fisher population in the southern Sierra that it will take several years and likely several decades for fisher populations to expand if fisher reintroductions were successful in the northern and central Sierra. The proposed treatments in both alternatives are intended to reduce the future risk and effects of large stand replacing fires which create large gaps that may be barriers to fisher movement. It is hypothesized that recent large fires in the last several decades may limit natural expansion of the existing population in the southern Sierras.

Concern has been expressed that treatments within the HFQLG Pilot Project area in Alternative S2 may increase fragmentation and create barriers to fisher movement. This is speculative at this point because fisher do not appear to inhabit the area. Even if fisher were reintroduced into northern California, it is likely that it would be several years after reintroduction before available habitats would become fully occupied. The proposed DFPZs are linear features up to one-quarter mile wide, however, most intensive treatments are within a 300’ wide core zone and a minimum 40% canopy retention is required in westside forests in CHWR classes 5M, 5D, and 6. These design features retain habitat elements within the range of those used by fisher for foraging and dispersal such that they are not likely to create large barriers to further expansion and connectivity for fisher.

Connectivity and Gaps

Existing bottlenecks, gaps, and areas of concern for spotted owls were identified by Verner et al. (1993). Many of these same areas may also restrict fisher dispersal and recolonization of suitable habitats. The primary impediments to fisher dispersal north of Yosemite are sparsely-vegetated areas resulting from large, stand replacing fires on the Stanislaus National Forest. Treatment of these areas to regenerate forest stands is ongoing and independent of this decision. The purpose of and need for the proposed action includes reduction of the size and intensity of stand-replacing fires in the Sierra Nevada. To the extent that treatments are effective in achieving this desired condition, the revised SNFPA will avoid the creation of additional gaps and barriers to fisher movement and so become an important component of maintaining viability of fisher populations in the Sierra Nevada. The threat of large stand replacing fires creating new large gaps and barriers to movement of fisher was identified as a major concern (Science Consistency Review, Supplement #1, 11/2003). Aubrey et al. (in press) found that expanses of unsuitable habitat as narrow as 30 miles might impede genetic exchange for fisher in the southern Oregon Coast Range.

Each of the Sierran Forests have developed strategies to provide suitable habitat for forest mesocarnivores (primarily fisher and marten), including corridors of habitat managed for connectivity. These networks or strategies have been incorporated by amendment into several of the land and resource management plans (LRMP). Where the networks or strategies have not been incorporated into the forest LRMP, they are assessed and incorporated into project level planning and implementation. The result is well distributed and connected habitats based on habitat availability and current or historic detections for marten and fisher, including eastside habitats. Where there are gaps due land ownership patterns or natural or human-caused fragmentation, the best connections available are identified and management activities maintain future options.

Reintroduction of Fisher to Suitable, Unoccupied Habitats

Appearance of fisher in previously-unoccupied habitat on the Sierra National Forest over the past 10 years has led to speculation that fisher may be dispersing northward from source populations on the Sequoia National Forest or established territories on the Sierra National Forest. Due to its limited size, the southern Sierra population may be too isolated to assure long-term species viability in this portion of its range. Reintroduction of fisher to the central and northern Sierra has been proposed and has strong support in the scientific and research community (R. Barrett response to the DSEIS, W. Zielinski, letter to Jack Blackwell, 9/2003). The Pacific Southwest Region, Forest Service supports reintroduction and will actively pursue partnerships in this effort as a feature of the SNFPA management strategy. Authority for managing wildlife populations, including reintroducing wildlife species rests with the California Department of Fish and Game. If the fisher becomes listed under ESA, authority will also include the U.S. Fish and Wildlife Service.

Habitat Conditions in the Short-Term and Long-Term

Habitat models (described in the section on the California spotted owl section and in Appendix B) indicate that across the bioregion habitat will improve significantly and fuel modification will be increasingly effective over time in protecting existing habitat, regardless of which alternative is selected. Habitat improvement for fisher will be in the form of increased number of large trees and stands dominated by trees over 24” dbh, increased average canopy closure, and larger patch sizes and acreage in CWHR classes 4 and 5, contributing to late seral old forest conditions. The short-term trade offs in current habitat quality to sustain long-term benefits are of greatest importance to fisher viability within the area of known occupancy, the SSFCA. Outside of the SSFCA, the greatest concern is the risk of further fragmentation due to large stand replacing fire. The FEIS included projections of improved habitat, connectivity, and opportunities for expansion of existing populations. These projections appear to remain valid in Alternatives S1 and S2, both within and outside of the SSFCA, barring occurrences of unpredictable events, such as large stand-replacing fires that further isolate or fragment existing fisher populations.

Risk and Uncertainty

High quality fisher habitat includes high shrub cover that lies on steep slopes at mid-elevation (3,500-8,000 feet) and perched above large, contiguous brush fields in the southern Sierra Nevada. These areas are at maximum risk of susceptibility to stand replacing fire. This area is also at high risk of ignition, due to relatively high levels of human presence, roads, and communities. High fuel loads, extensive ladder fuels, and large sizes of down woody material create considerable resistance to control and unsafe conditions for firefighting. As such, large blocks of untreated habitat may be sacrificed for indirect fireline construction and backfires. Fire effects analysis supports the contention that these areas are highly susceptible to stand replacing loss.

Large stand-replacing fires have created several gaps in Sierra Nevada fisher habitat through recorded fire history (FEIS volume 2, part 3.5, pages 258-259). The effects of large, stand-replacing fires are particularly evident on the Sequoia, Stanislaus, Eldorado, and Tahoe National Forests, as well as on significant areas within Yosemite and Sequoia/Kings Canyon National Parks. This habitat zone is believed to have had a presettlement fire return interval of 10-25 years (Skaggs 1996), which was unlikely to have sustained vast tracks of suitable fisher habitat over the landscape. Suitable habitat conditions are actually enhanced by fire exclusion. However, fire exclusion is generally regarded as unsustainable over the long term, because the greater the fire return interval departure (departure from the expected return interval), the greater the likelihood of high intensity fire and adverse effects on habitat.

The effects and probability of stand replacing fire on spotted owls is described in detail in chapter 4 and would be similar for fisher. Most of the same assumptions and effects apply to fisher habitat. The risk that any particular acre will burn with stand-replacing intensity in any single year is low; however, because adverse effects persist over the long term, the potential consequence of this risk are significant. Fire scars from fires in the 1930s on the Sequoia National Forest within the range of potentially suitable fisher habitat have little or no natural regeneration. Areas burned by large, stand-replacing fires on the Sequoia National Forest generally do not support fishers or spotted owls, except along peripheries or in isolated islands. Even these areas do not appear to support reproductive pairs. Thus, maintaining existing conditions over the long term presents a high degree of risk and uncertainty to viability of fisher in the Sierra Nevada.

Conditions on the Sequoia National Forest provide context for the vegetation-management treatments under consideration. Timber harvest on the Sequoia National Forest ranged up to 100 MMBF during the mid to late 1980s. Timber output has varied considerably but has averaged approximately 75 MMBF since the 1940's. Approximately 23,000 acres of plantations exist outside of large fire areas, as a result of 10-40 acre clearcuts or extensive private land harvest prior to acquisition by the Forest Service. This plantation acreage compares with more than 50,000 acres of large openings or sparse stands that overlap with areas of large fires. Most suitable habitats within the Sequoia National Forest outside of wilderness areas have been surveyed for fisher and spotted owl. Most suitable habitats within the national forest, except areas of large, stand-replacing fires and some areas of harvest prior to Forest Service acquisition, appear to support spotted owls and fisher. Areas of large, stand-replacing fire do not support these species. Areas of extensive private land harvest—where historical photographs (Hume Lake Ranger District files) indicate that all moderate and large trees were removed in the late 1800s and early 1900s—now support fisher, marten, goshawk, and spotted owl (e.g. Big Stump, Sequoia/Kings Canyon National Park and, Indian Basin, Hume Lake Ranger District, Sequoia National Forest).

In addition, Laymon (1981) found high density of fisher on portions of the Hot Springs Ranger District, an area extensively logged after the 1940's. Zielinski et al. (1996) found extensive, high-density fisher presence, with smaller estimated home ranges than have typically been observed in other fisher studies on the West Coast. Fisher density may be adversely affected by large clearcuts (Soutiere 1979) but may be only slightly affected by partial cutting (Steventon and Major 1982). Self and Kerns (2003) found that fisher used stands having 25-40% canopy closure if an adequate number of high density groups, 0.1 acre and larger, were available for rest sites. Mazzoni (2002) and Zielinski et al. (in prep) found that fisher select home ranges in high density (> 60% canopy cover) mixed conifer stands but observed that home ranges also included 32-67% of habitat with less than 50% canopy cover. Both studies indicated that landscapes surrounding home ranges had significantly less high density habitat. This data suggests that some flexibility is possible in designing treatments on a landscape scale that will not compromise current fisher occupancy.

The previous discussion helps to provide a context for comparing effects of proposed management actions with effects of large stand replacing fires. The proposed treatments would be designed to retain large trees and a minimum of 40% canopy closure, with a goal of 50% canopy closure or greater. As such, the treatments would create habitat conditions that are within the range of habitats used by fisher and would not therefore involve an irreversible or irretrievable commitment of resources. The future occurrence of large stand-replacing fires is less predictable than the proposed vegetation treatments, but large fires have affected an average of 43,000 acres/year averaged over 30 years. The average area burned per year within the analysis area has increased to 80,000 acres/yr considering only the past 10 years. The entire acreages of all large fires are not all stand replacement, but significant portions of each fire represent a loss of resources that is irretrievable within the human lifespan.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 6-18.

Large Trees

The analysis indicates that under either alternative, a trend toward higher numbers of large trees will develop. This is based on predicted growth and recruitment of large trees as a result of thinning smaller stands and on lower loss of large trees to stand-replacing fire as a result of more aggressive fuels treatment. This also reflects measures for protection of existing large trees, including retention of all trees ≥30”, retention of at least 40% of the existing basal area in the largest tree size class (Alternative S2 only), and application of treatments on approximately 25-30% of firesheds. The two alternatives would have nearly indistinguishable effects over the next 20 years. Inventory indicates that average conditions currently include approximately ten trees per acre ≥30” dbh. This figure would rise to approximately sixteen trees per acre ≥30” dbh in 20 years under either alternative.

Surveys of representative old forest/late seral stands under assumed natural conditions indicate approximately six-seven trees per acre ≥30” dbh for typical mixed conifer forest in the Sierra Nevada. (Potter et al. published and unpublished definitions of old forest types). This level of large trees meets one criteria for high quality fisher habitat as compiled by Freel (1991). Approximately 75% of the mature forested stands across the SSFCA will remain untreated after the first two decades of proposed treatments. Within treated areas, the number of large trees will not diminish in treated areas but will increase due to growth and succession.

Canopy Cover

Differences in standards and guidelines between Alternatives S1 and S2 that affect canopy closure include:

- Limitation on the size of tree that can be removed for fuel treatments in 1 acre or larger patches of CWHR classes 5M, 5D, or 6 would be modified under Alternative S2,

- Canopy cover retention would be changed from limiting change to no more than 20% reduction under Alternative S1 to no more than 30% reduction under Alternative S2. The minimum canopy closure goal is 50% for both alternatives, but reduction to 40% is acceptable under Alternative S2 where site-specific project objectives cannot otherwise be met. Canopy cover retention guidelines are influenced by land allocation desired future conditions.
- Change in management of California spotted owl and northern goshawk PACs within WUIs under Alternative S2 would allow mechanical treatments within the threat zone where it would reduce impacts to vegetation from prescribed burning alone or is needed to achieve fuels reductions within treated areas. The greater certainty in canopy closure, down log and snag retention from using mechanical treatment (compared to uncertain levels following prescribed burning treatments) may provide benefits to fisher.
- Retention of at least 40% of existing basal area in the largest trees and at least 5% in small trees would promote the development of multiple layered canopies over time under Alternative S2.

Projected average canopy closure across the SSFCA indicates that no significant difference between Alternatives S1 and S2 would develop after 20 years. Mean canopy cover of the forested portion of the SSFCA is currently 51%. Analysis for both alternatives shows a steady rise in average percent canopy closure as gaps and sparse areas fill in. More extensive thinning, including a potential reduction to 40% minimum canopy cover, would result in a slower increase in average canopy closure under Alternative S2. However, over the long-term Alternative S2 is projected to result in more areas of higher canopy closure than Alternative S1, because of the reduced effects of stand-replacing fire.

Forty percent canopy closure is within the range of canopy cover in habitats used by fisher for foraging and dispersal. Such thinning should not limit connectivity between stands of higher canopy cover, denning-quality habitat, because proposed treatments would only affect approximately 25-30% of the forested area. Effects on denning and resting habitat would vary by project. Self and Kerns (2003) found that male fishers used second growth stands having 25-40% canopy closure for foraging, as long as groups or clumps ≥0.1 acre having >60% canopy closure were situated around suitable rest sites that were dispersed throughout the available habitat.

Table 4.3.2.1a shows characteristics of the areas within the SSFCA that are proposed for treatment under Alternative S2. Wildland treated areas are intended to reduce intensity of wildland fire and adverse effects on watershed and wildlife habitat and have a lower priority for treatment. Of the available 469,000 acres of habitat having >50% canopy cover within the SSFCA, approximately 323,500 acres or 69% would not be treated under Alternative S2. Additional untreated area would be available in wilderness, other areas designated as unsuitable for treatment, and in adjacent National Parks. Approximately 16% of the available habitat having high canopy closure could be treated the WUI under this alternative.

Table 4.3.2.1a. Proposed Treatments by Vegetation Type/Condition in the SSFCA under Alternative S2 (Acres).

Vegetation Type/Condition	No Treatment	Defense Zone	Threat Zone Area treatments	Wildland Area treatments	Total	Projected for Treatment	Percent of Category	Percent of SSFCA
Non treated	362,445	1,225	79	1,221	364,969	2,524	0.69%	0.20%
Less than 40% canopy closure	70,055	4,097	13,186	12,060	99,397	29,342	29.52%	2.27%
40-50% canopy closure	48,429	2,362	5,875	11,280	67,946	19,517	28.72%	1.51%
Greater than 50% canopy closure	323,460	27,449	46,614	71,300	468,823	145,363	31.01%	11.24%
Brush-shrubs	106,390	2,071	10,825	14,608	133,894	27,504	20.54%	2.13%
Grasses	25,042	349	924	1,188	27,503	2,460	8.95%	0.19%
Plantation	54,477	2,913	6,929	10,966	75,285	20,808	27.64%	1.61%
Non vegetated	47,846	597	1,641	4,833	54,918	7,072	12.88%	0.55%
Total	**1,038,146**	**41,065**	**86,071**	**127,456**	**1,292,738**	**254,592**	**19.69%**	**19.69%**

Note: Non-treated includes minor inclusions such as rock outcrop, areas where no treatment is needed such as grasslands, areas within treated areas or wilderness, and other areas unsuitable for treatment but not classified in the other categories.

At the programmatic level of this document, estimating the number of fisher territories that might be affected under either alternative is difficult, because broad scale mapping of territories is not available. Landscape scale assessment at the subwatershed scale was used to identify areas of potential conflict, i.e. where treatments may reduce the fraction of high density habitat below 50% of the forested area. Of the 355 subwatersheds (HUC6) within the SSFCA, in 46 subwatersheds 50% of the forested portion has at least 60% canopy closure and 500 acres of dense habitat in trees of CWHR size class 4 or greater. Assuming all treatments are within habitats having ≥60% canopy closure; the maximum potential impact would reduce the fraction of habitats having high canopy closure to below 50% of the landscape in 36 subwatersheds. The proportion of suitable habitat having at least 40% canopy closure would not be changed in any watersheds.

Snags

Current snag levels over much of the SSFCA are near snag levels thought to be reflective of old forests, as measured on unmanaged sites (Potter, personal communication 2003). Based on model projections, conditions under Alternatives S1 and S2 would not be significantly different in 20 years. Both alternatives are modeled to result in an approximately 25% increase over current large snag levels. Projected over the long term, Alternative S2 would result in a lower level of snags than Alternative S1. However, under Alternative S2, snag levels would still be doubled over current conditions. Like Alternative S1, Alternative S2 includes guidance to identify important legacy elements, such as large snags, and protect them during fuels treatments. Preference for use of mechanical equipment within the SSFCA to protect snags, down logs, and legacy elements is common to both alternatives, as are guidelines for the retention and recruitment of large trees to become large snags over time. Alternative S2 would not involve significant change in management of large snags for fisher relative to Alternative S1. Therefore, snags are not further addressed in this analysis.

Coarse Woody Debris

Standards for down woody debris will result in essentially the same effects under Alternatives S1 and S2.

Intermix of California Black Oak and Canyon Live Oak in Suitable Coniferous Habitats

Effects to suitable oak habitats would not differ between Alternatives S1 and S2.

Management of Human Presence and Associated Activities

Alternative S1 specifically requires evaluation of the effects of existing recreation and ongoing management activities on fisher den sites. This direction is not included in Alternative S2. In Alternative S2, effects of recreation and other forest activities would be evaluated when new activities are proposed or when permits are reissued. Existing permits can be reviewed and amended if adverse effects to fisher are discovered.

Direction for management of the roads system would be the same under Alternative S1 or S2. However, Alternative S2 allows full implementation of the HFQLG Pilot Project, which would involve an increase in road mileage within the pilot project area. Proposed roads would be constructed to the minimum standard necessary to provide access to group selection units and DFPZs for initial treatment and subsequent maintenance. The proposed roads would be designed for minimal use by high clearance vehicles. These low standard roads would not be expected to induce substantially increased traffic or support speeds that increase roadkill of fisher.

Fisher Distribution and Abundance

Direction for survey and monitoring would be the same under both Alternatives S1 and S2. Both alternatives include direction to manage newly discovered territories to provide suitable habitat within estimated home ranges.

Protection of Selected Fisher Sites

Protection of fisher den sites is the same for both alternatives. Although there are only a limited number of detections, most known sites are in and around communities or near roads and other potentially harmful disturbances. Fisher appear to have adapted to these disturbances and continue to use territories in close proximity to humans. Thinning within the WUI may alter habitat and shift use further away from communities and result in less exposure to human disturbance. Large tracts of untreated habitat will remain outside of the WUI to provide suitable denning sites.

Although, guidelines require a 700 acre buffer for each natal or maternal den site, many of the den sites represent multiple detections of the same female. Complete overlap of buffers for these den sites within a single territory meets the intent of the guidelines.

Abundance of Old Forest Conditions

Alternative Modified 8 in the FEIS included projections of improved habitat and habitat connectivity for fisher. This was accomplished by maintaining large trees wherever they occurred and limiting treatments that reduce canopy cover to a small proportion of the total landscape. Alternatives S1 and S2 include the same standards and guidelines to manage and evaluate fragmentation effects at both the project and landscape scale and therefore are projected to have similar outcomes for old forest conditions. This increase in habitat and habitat connectivity should provide the opportunity for expansion of existing populations.

Fisher Diet/Prey Habitat

Fisher use a diverse array of prey. The extent of foraging habitat under either Alternative S1 or S2 would not limit populations, assuming that cover and appropriate rest sites are well-dispersed over their territories. Prey availability would be the same for Alternatives S1 and S2.

Effects Conclusion

The primary potential effect on fisher of Alternative S2 compared to Alternative S1 would be the result of different standards and guidelines affecting canopy closure. Despite the differences, habitat projections indicates that little or no difference in average canopy closure would be expected at a landscape scale. The spatial pattern of treatments in both alternatives should avoid creating significant barriers to movement. Specific effects on potential fisher movement across landscapes would be evaluated at the project level considering site-specific vegetation patterns and other barriers such as roads under the standards and guidelines of both alternatives.

Guidelines have not been developed specifically for fisher habitat within the eastside pine vegetation type. Habitat conditions are highly variable across that landscape, and developing broad, programmatic guidelines that would fit the habitat variability associated with fisher use of eastside pine is not practical.

The Pacific Southwest Region of the Forest Service is developing a conservation assessment for fisher, scheduled for completion in fall of 2004. This conservation assessment will consider the best available scientific information and provide the latest status of knowledge about fisher in the Sierra Nevada which will aid in evaluating the effects of the direction provided in the current alternatives. There are additional recommendations made for fisher as a part of the Adaptive Management Strategy in Alternative S2 (see chapter 2), including continuation of status and change monitoring, completion of existing research, completion of the Kings River Demonstration Project, and initiation of exploring a fisher reintroduction program with federal and state partners.

Cumulative Effects

Habitat attributes important to fisher—large trees, large snags, large down logs, and higher than average canopy closure—would be similar under Alternative S1 and S2 and amounts would significantly trend upward over time under both alternatives. Landscape level attributes such as spotted owl nesting habitat, mature forest, and LSOG conditions would also trend upward, which would result in greater connectivity and lower fragmentation of fisher habitat over time. Vegetation management activities under either alternative would generally be of fine-scale and would allow for relatively quick recovery of habitat characteristics, compared to the much larger and more disruptive effects of stand-replacing disturbances such as wildfire. Treatments under Alternative S2 more effectively reduce fuels within treated areas and are projected to result in a greater reduction in wildfire size and intensity across treated landscapes than under Alternative S1. Although this difference is important in determining habitat and population outcomes for fisher, much of the decrease in fire effects under Alternative S2 would not become evident until after the 20-year analysis horizon. There is greater uncertainty associated with estimating longer-term effects. The guidelines for Alternative S2 would result in retention of at least travel and foraging habitat, such that large tracts would not be rendered unusable as would be the case after stand-replacing fire. If undesirable effects materialize from implementing the thinning prescriptions, recovery would be relatively fast compared to recovery after stand-replacing fire.

Initial treatments are focused on the WUI and occur in a strategic pattern across landscapes. Large tracts of suitable fisher habitat are retained outside of the WUI. Forest and region-wide monitoring, as well as adaptive management studies for the Kings River Demonstration Project (KRDP), will be designed to provide information regarding the effects to fisher populations from implementing the fuels reduction strategy in the WUI on fisher populations. Monitoring in areas of known overlap between fisher territories and the WUI will provide opportunities for adjusting fuels treatments, as more information becomes known. This strategy for dealing with uncertainties would apply to both Alternatives S1 and S2.

The habitat and population outcomes for Alternative S2 would not be significantly different from those of Alternative S1. The largest events affecting viability of fisher populations in the southern Sierra appear to be large stand replacing wildfires. Past large wildfires affected large patches of habitat across the Sierra Nevada and resulted in a large barrier to northward movement of fisher on the Stanislaus National Forest.

Additional cumulative effects since publication of the SNFPA ROD resulted from the McNally Fire, which burned approximately 155,000 acres in 2002 on the Sequoia and Inyo National Forests. Approximately 17,000 acres of suitable and presumed occupied habitat burned with stand-replacing intensity. The Sequoia National Forest subsequently conducted track plate surveys and found fisher within the area, including some detections within the severely burned areas. Track plate surveys will continue to be used to track fisher use of the area. The area burned by the McNally Fire may present a barrier to movement between the Kern Plateau subpopulation and other subpopulations to the west of the Kern River. All linkages of suitable habitat were severely burned. Fisher movement is limited to the south by open grassland, rock outcrop, and burned chaparral habitats within the steep Kern Canyon, and to the north by open, rocky habitat dissected by sharp escarpments of the glaciated upper Kern Canyon. All conifer habitats were removed up to ½ to 2 miles from the Kern River on both sides of the river's canyon from Johnsondale Bride to Hell Hole (a zone 10-15 miles in length). The Sequoia National Forest is exploring options to replant and recreate travel cover as quickly as possible.

Managers are concerned about the cumulative effects on fisher of adaptive management studies of the KRDP on the Sierra National Forest and potential changes in management under the Giant Sequoia National Monument (GSNM) Management Plan. Together these two administrative units affect approximately 29% of the SSFCA.

Kings River Demonstration Project

The KRDP is a combination of an administrative study and several research studies that uses uneven-aged management of small groups and prescribed fire to examine effects and management options related to spotted owls, fisher, forest birds, watershed function, and other aspects of resource management. The study area is approximately 132,000 acres, of which 80,000 acres are forested and have been divided into eighty management units. The study plan envisioned the creation of small reforestation groups on approximately 10% of each 1,000-acre unit every 20 years (equivalent to an overall rotation of 200 years). Treatments are creating openings ranging from 0.25 to 3 acres, with the average being about 1.25 acres. Legacy elements are being retained in the treatment units, such as large trees (>35"dbh) and down logs.

The matrix of each management unit is being thinned, concurrently with creation of the small reforestation groups. Thinning is intended to accentuate the existing uneven-aged structure of the stand and change the species composition toward that of the presettlement forest. Stands are being thinned using silvicultural prescriptions that are tailored to site quality, vegetation type, and ages of trees. Stands are typically thinned to achieve 65% of *normal stocking.* (*Normal stocking* is the minimum density of trees such that competition based mortality is present) (Forest Service Handbook 2409.26). Basal area of normal stocking may vary from 300 square feet per acre in fir and mixed conifer stands to 200 square feet per acres or less in some pine-dominated stands. The standard silvicultural prescription for thinning 50-100 year old stands to maximize timber growth and value require thinning to approximately 55% of normal stocking. The greater retention of basal area under the KRDP is intended to produce habitat characteristics required by fisher and spotted owl. The purpose of thinning in the matrix is to accentuate the clumpy or grouped characteristics of the existing forest, which, according to results of research, produces habitat that can be used by owls and fisher.

After 50 years, up to 25% of each management unit in the KRDP will have been converted into small reforestation groups and have trees ranging in size from seedlings to large poles. Opening sizes will be within the range of opening sizes used by fisher. The matrix will be managed to keep levels of canopy closure within the range found in habitat used by fisher for denning and foraging. Because adjacent units are not being treated within five or more (typically at least 10) years of one another, stands adjacent to treated stands may provide habitat with suitably high canopy closure.

Uncertainties associated with anticipated effects on fishers are one of the principle reasons that the administrative study and research are being conducted. Most previous studies have contrasted the effects of large clearcuts with the effects of no management or light stand management. As noted above, fisher are able to occupy logged areas. Suitable habitat conditions can be restored in a relatively short period of time after logging, compared to after a stand replacing fire, as long as legacy habitat elements are retained. The KRDP is designed to retain habitat elements that allow relatively rapid restoration of habitat, if unintended adverse effects are determined to be occurring. Research and monitoring is being conducted to determine effects, and management will be adapted as necessary based on these observations. Several fisher within the study have been fitted with radio collars to determine use of stands prior to treatment.

Giant Sequoia National Monument

The final environmental impact statement for the GSNM Management Plan will be available in late 2003.

The following cumulative effects are expected within the GSNM:

- Treatments designed to reduce risk of stand replacing fire to objects of interest will be substantially completed within three decades of implementation. Protection treatments would be generally located in areas currently highly susceptible to stand replacing fire, are in the wildland urban interface, or in areas designed to protect other key resource values. After treatment, these areas would have reduced susceptibility, thereby reducing the risk of damage from stand replacing fire. In addition, monitoring data indicates that prescribed fire activities in low to mid elevation mixed conifer-giant sequoia vegetation will lead to a 60% to 80% total fuel reduction (measured in tons per acre).
- Within 20 years under all alternatives, approximately 1/3 of the acreage of the monument will have fire re-introduced as part of initial treatments under the protection strategy or the restoration strategy.
- The amount of large trees will increase, leading to an increase in the quantity and quality of old forest habitat.
- The patches of new vegetation that are established from prescribed burning or mechanical thinning will increase the variety of age classes and tree sizes and promote an overall mosaic of vegetation both within stands and across the landscape.
- The structures of the giant sequoia groves will shift towards desired conditions as patches of young vegetation are established, which includes giant sequoias. Density of trees in the 30 to 130 year old age class will be reduced, further helping to meet desired conditions. The treatments will thin out high amounts of trees in the understory and occasionally in the overstory canopy. A long-term effect of reduced tree density from fire (both from initial treatments and follow-up burning) is the increased opportunity for larger trees that escape severe damage or death from fire to grow more rapidly than under more dense stand conditions. Based on monitoring of prescribed fire activities in the adjacent Sequoia National Park, the reduced tree density "…falls within the range that may have been present prior to Euroamerican settlement, based on forest structural targets developed with input from research, historic photos, and written accounts…"
- The amount and/or vigor of young trees less than 30 years old will increase as existing patches are thinned out while being protected from excessive mortality from fire as new patches are established after treatment creates new gaps.
- In the short-term (estimated at up to 50 years), hardwood density in conifer stands may increase due to the opened stand conditions after prescribed burning and/or thinning. In the long term, however, hardwood density may be reduced back to current levels as amounts of large trees increase and shade out hardwoods, which generally do not grow to the average heights of conifer trees.

- The capacity of giant sequoia trees and surrounding landscapes to adapt to changing environmental conditions would increase compared to existing conditions. This is due to the restoration of conditions more reflective of pre-1875, such as a more frequent fire return interval, reduced fire intensities, new patches of vegetation, and improved health of trees after treatments.

For the purposes of estimating cumulative effects in this document, future management of the GSNM was modeled using a modification of Alternative 6 of the draft GSNM FEIS, to simulate the mid range of the potential effects of the various alternatives.

Habitat

The current status of this species suggests that suitable environments are distributed primarily in patches that are not abundant. Gaps where suitable environments are in low abundance are large enough to isolate subpopulations, limiting opportunities for species interaction across the national forests. Some populations are so disjunct or of such low density that they are essentially isolated from other populations. Alternative S2 would lead to some improvement of this situation over the planning horizon, while Alternative S1 would maintain the status quo, when considering the risk of stand replacing events in occupied habitat.

There are fewer restrictions on reduction of canopy closure in Alternative S2, however, habitats outside of the WUI are projected to remain suitable. Under Alternative S2, treated areas are generally 100 -150 acres in size and limited to 25-30% of the landbase. Thus, although some denning habitat may be degraded, the degraded patches would be a smaller inclusion within a larger matrix of untreated habitat that would likely retain habitat elements suitable for numerous denning and resting sites across a landscape or territory. The degraded patches would not make habitat unsuitable or unusable for fisher and they would remain as inclusions within existing fisher territories.

Population

The current status is attributed to the combination of environmental and population conditions that restrict the potential distribution of the species. The range is characterized by areas with high potential for further population isolation and very low potential abundance. While some of the existing subpopulations my be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough to limit opportunities for interaction among them. Both Alternatives S1 and S2 would lead to an improvement over the current condition. Under S2, commitment to reintroduce fisher in the central and northern Sierra and providing for the continued natural expansion of the southern Sierra fisher population would significantly improve population outcomes.

4.3.2.2. Marten

Factors Used to Assess Environmental Consequences

1. Protection and recruitment of large old trees
Measure: large trees

2. Retention of dense forest canopy
Measure: canopy closure

3. Retention and recruitment of large snags
Measure: large snags

4. Retention and recruitment of large down wood
Measure: coarse (large) woody debris

5. Presence of meadows and riparian habitat in proximity to conifer forests
Measure: meadows and riparian habitat

6. Human presence
Measures: recreation and roads

7. Distribution and abundance of martens
Measure: survey requirements and status and trend

8. Management of reproductive sites and protected areas
Measure: protected areas for martens

9. Quality and quantity of habitat
Measure: abundance of old forest conditions

10. Quality, quantity, and distribution of prey species habitat
Measure: acres of prey species' habitat

Analysis Assumptions and Limitations

The assumptions and limitations used in this analysis are described in detail in the FEIS (chapter 3, part 4.4, pages 25-28) and are hereby incorporated by reference.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 24-35.

Large Live Trees

Alternatives were compared with respect to the number of large, live trees that would be present, using categories of *very large trees* (> 50" dbh) and *large trees* (>30" dbh on the westside >24" dbh on the eastside, and >21" dbh in alpine zones)

In the short term (20 years), Alternatives S1 and S2 would result in similar amounts of large and very large trees; with a marginally greater amount present (0.25%) under Alternative S2. In 20 years, approximately 23 to 25% more large and very large trees would be present under either alternative compared to the present condition, as a combined result of large tree retention standards and projected growth of smaller size classes.

Large and very large trees would also be present over the long term (130+ years) within the range of natural variability under either alternative. However, 18% more would be present in the long term under Alternative S2, primarily due to the anticipated reductions in wildfire size and intensity. Yet, for the eastside pine type, Alternative S2 may result in a greater risk to large tree retention by raising the maximum diameter limit of trees that can be cut from 24" to 30." However, this change in minimum size retention will likely be offset by the requirement to retain 30% of the existing basal area in the largest trees available.

Dense Forest Canopy

At a landscape scale, canopy closure is projected to vary little between the alternatives. Regardless of which alternative is implemented, the same proportion of the bioregion would be managed to create strategically placed area treatments. Similarly, the acreage within defense zone proposed for treatment is the same. The difference is that Alternative S2 has less restrictive canopy closure retention requirements. Alternative S2 allows up to a 30% reduction in canopy cover for vegetation and fuels management treatments, whereas Alternative S1 only allows a 10-20% reduction, depending upon land allocation and stand condition. However, canopy cover retention in Alternative S2 is also influenced by the combined effects of basal area retention and large tree retention requirements. In the short term (20 years), implementation of Alternative S2 is projected to result in less than 1% lower average canopy closure than Alternative S1. In the long term (130+ years), Alternative S2 is projected to result in a small increase in canopy closure (3%) compared to Alternative S1. In the eastside pine type, Alternative S2 may provide less assurance of canopy closure retention, because limits on reduction of canopy closure would be eliminated. However, this change may be offset by the requirement to retain 30% of the existing basal area in the largest trees available.

Canopy cover reductions may affect approximately 25% of the landscape under both alternatives. Treatments under Alternative S2 may include reduction to a minimum of 40% canopy cover where the 50% canopy cover goal cannot be met due to site specific conditions. Effects on marten habitat under either alternatives may be less than anticipated because they occupy habitats at higher elevation than the majority of proposed treatments. Proposed treatments will have less effect on red fir and habitats above 8,000’ where there is less risk of stand replacing fire and few communities at risk. Bull and Heater (in press) found that radio-collared martens in their study area avoided all harvested and unharvested stands having less than 50% canopy closure. However, previous studies have shown that marten will use harvested areas (Steventon 1982, Kucera 2000, Self and Kerns 2001). Marten typically avoid habitats having less than 30% canopy cover (Koehler et al. 1975, Steventon et al. 1982, Spencer 1981), however, Kucera (2000) identified marten home ranges having an average of 20% canopy closure, including areas above treeline in eastside habitats. Treatments under either alternative may reduce habitat quality for marten, but conditions in the resulting habitats would still be within the range of conditions of suitable marten habitat, provided adequate levels of ground cover and down logs remain onsite.

Snags

Under alternatives S1 and S2, the number of snags >15” dbh is projected to increase gradually for approximately 100 years and then remain relatively constant. Although both alternatives have more snags in the future, Alternative S1 is projected to have approximately 6% more snags than Alternative S2, in both the short and long term, partially as a result of the increased occurrence of wildfire. Snag retention requirements are similar for Alternatives S1 and S2, and adequate numbers of snags to meet desired conditions would be present under the alternatives.

Coarse Woody Debris

Standards for down woody debris are essentially the same under Alternatives S1 and S2.

Meadow and Riparian Habitats

At the landscape level, little appreciable difference in meadow and riparian habitats is projected for Alternatives S1 and S2. With the exception of changes to the standards and guidelines for the willow flycatcher and Yosemite Toad, the AMS goals and standards are the same for Alternatives S1 and S2. Thus, meadow and riparian habitat conditions are expected to be similar under either alternative.

Recreation

Alternative S1 includes a requirement to apply limited operating periods (LOPS) to all new projects within marten site buffers. Alternative S2 applies the above LOPs to vegetation treatments only. A requirement to evaluate new and ongoing activities for their potential to disturb known den sites is included in Alternatives S1 and S2. Few marten den sites have been identified and the alternatives are expected to have essentially the same effects. As new marten den sites are discovered, existing activities that may adversely affect marten reproduction will be evaluated in either alternative and existing permits will be re-evaluated as needed.

Roads

Alternatives S1 and S2 involve the same direction for road system management. However, Alternative S2 allows full implementation of the HFQLG Pilot Project, which would involve an increase in road mileage within the pilot project area. Proposed roads would be constructed to the minimum standard necessary to provide access to group selection units and DFPZs for initial treatment and subsequent maintenance. The proposed roads would be designed for minimal use by high clearance vehicles. These low standard roads would not be expected to induce substantially increased traffic or support speeds that increase roadkill of marten.

Survey Requirements

Broad-scale, systematic surveys would be conducted to detect presence of the species in Alternatives S1 and S2.

Trend in Population Size

Determining marten reproductive success is difficult due to the secretive nature of the species. Despite its widespread occurrence across the Sierra Nevada with regular sightings of individuals, few den sites are known. Current survey and monitoring methods to determine demographic information would thus be costly and difficult to conduct. Neither Alternatives S1 nor S2 include direction for obtaining demographic information; therefore, population status and trend across the Sierra Nevada would remain uncertain under both alternatives.

Protected Areas

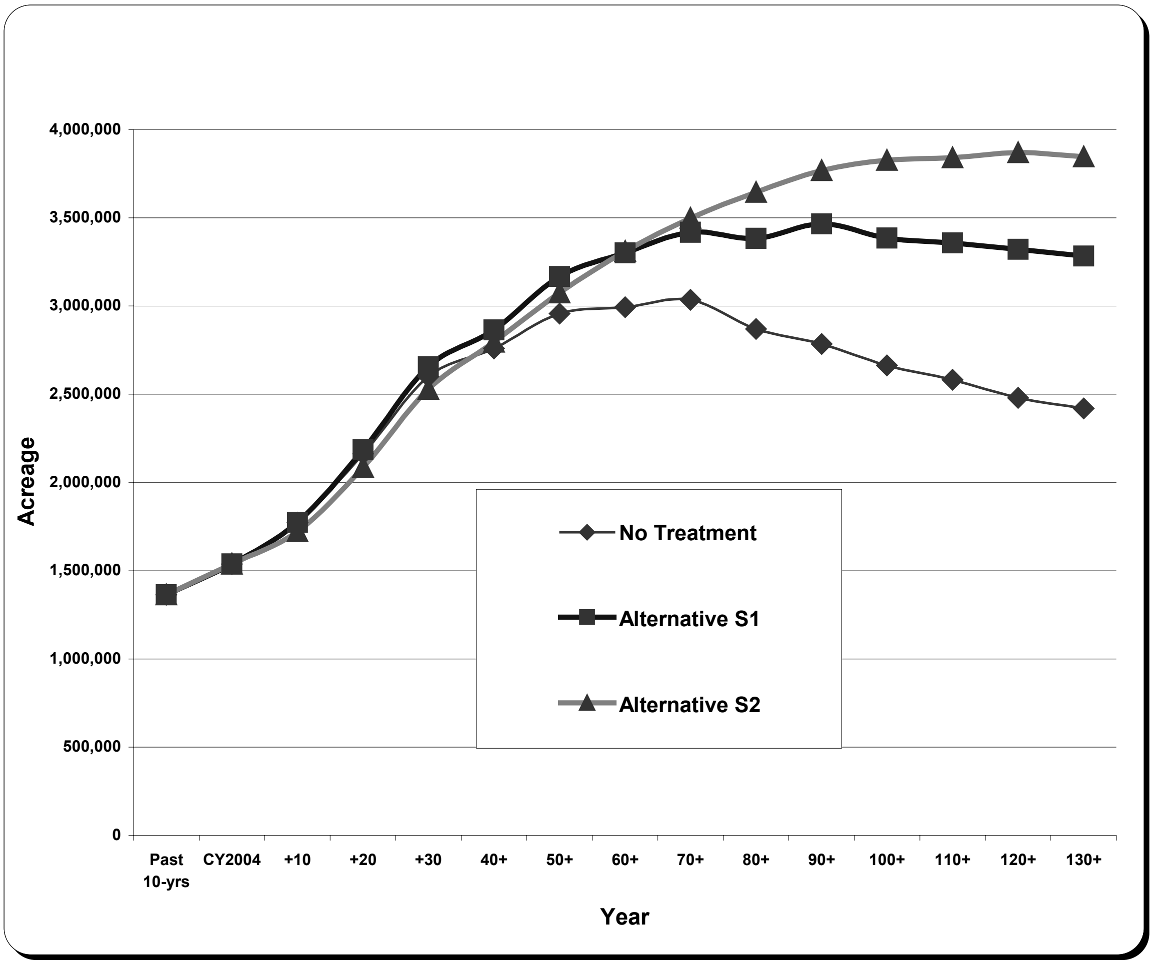
Both alternatives would provide protection for marten where they co-occur with fisher in the SSFCA. In addition, under both alternatives 100-acre buffers would be established around verified marten natal and kit rearing dens. Den site buffers would be protected from disturbance from vegetation treatments with a limited operating period (LOP) from May 1 through July 31 under both alternatives. Under Alternative S1, the LOP would also apply to new activities other than vegetation treatments. Under Alternative S2, existing Forest Service policy for biological evaluations would assure that these activities are adequately analyzed when projects are proposed, and that LOPs could be established, if necessary, to protect den sites from disturbance.

Quality and Quantity of Habitat

Important forest types for marten include red fir, lodgepole pine, subalpine conifer, mixed conifer-fir, Jeffrey pine, and eastside pine (Zeiner et al. 1990b). The following CWHR habitat stages are moderately to highly important for the marten: 4M, 4D, 5M, 5D and 6. Differences in standards and guidelines for vegetation treatments within strategically placed area treatments account for changes in habitat. The quantity of marten habitat is predicted to increase modestly under both alternatives, with greater short-term increases projected for Alternative S1 and greater long-term increases projected for Alternative S2.

Figure 4.3.2.2a displays projected acreage of late seral stage forest (CWHR classes 5M, 5D and 6), which provides the highest quality marten foraging and reproductive habitat. Under Alternative S1, the total amount of late-seral forest is projected to increase from the current level of 1,878,287 acres to 2,527,416 acres (35% increase) within 20 years. Under Alternative S2, the amount of late-seral forest is projected to increase to 2,510,394 acres (34% increase) during the same time period. By the end of the analysis period (150 years) the amount of late seral forest is projected to increase to 4,149,878 acres (121% increase) or 4,519,670 acres (141% increase) for Alternatives S1 and S2 respectively. However, there is considerable uncertainty in long term projections of habitat. Although the reliability of the precise numbers are limited, the overall upward trend is reasonable, given the underlying assumptions. The mix of CWHR classes would change similarly under either alternative, with short and long-term reductions in classes 4M and 4D and commensurate increases in classes 5M and 5D. Under Alternative S2, CWHR class 6, which is important to martens for its near-ground cover, would be moderately less in the short term relative to Alternative S1, but it would be present in greater amounts after approximately 70 years.

Figure 4.3.2.2a. Projected Region-wide Acreage of CWHR 5M, 5D, and 6 Late Seral Stage Forest (All Types).



(Source: USDA Forest Service, Pacific Southwest Region 2003i.)

When comparing alternatives for effects on marten, protection of habitat from wildfire is an important consideration. Under Alternative S1, wildfire acreage per year is projected to remain constant or increase slightly from current conditions over the long term. Conversely, the acreage expected to experience wildfire each year is projected to decrease under Alternative S2. The acreage projected to experience lethal or stand-replacing wildfires follows a similar trend to the wildfire trend for both alternatives.

Prey Species

Prey species availability is likely to be more critical during winter months, when many animals commonly included in marten diets are not available. During the summer, voles, chipmunks, and squirrels are relatively abundant. During the winter, only a few of these species (e.g. Douglas squirrel, northern flying squirrel) are readily available and probably help marten survive the severe Sierran winters. Habitat for both Douglas squirrel and northern flying squirrel is projected to increase slightly under both alternatives, with a slightly higher increase anticipated under Alternative S2 (Table 4.3.2.2a).

Table 4.3.2.2a. Projected Changes in CWHR Habitat Utility for Selected Marten Prey Species over 140 Years for Alternatives S1 and S2.

Year	Habitat Utility Under S1 (acres)	Habitat Utility Under S2 (acres)	Habitat Utility Ratio S2/S1 (%)
Northern flying squirrel			
2004	2,529,015	2,529,015	100.0
2024	2,659,424	2,684,493	100.9
2144	3,238,535	3,375,577	104.2
Douglas squirrel			
2004	2,683,991	2,683,991	100.0
2024	2,798,936	2,859,779	102.2
2144	3,342,573	3,525,841	105.5

(Source: USDA Forest Service, Pacific Southwest Region 2003i.)

Red squirrel and snowshoe hare are also prey items for marten, and reductions in their habitat and resulting populations could affect habitat use by marten. In addition, marten may be unlikely to venture in and forage in treated mixed-conifer stands, if the canopy cover drops below 50%.

Vegetation Composition and Structure

Overall, neither alternative would pose a significant risk to marten persistence and continued distribution throughout the Sierra Nevada bioregion. Large live trees would be retained at sufficient levels over time to represent a low risk to the species relative to this habitat element. Alternative S1 would present a lower level of risk than Alternative S2 because some portion of the acreage within individual treatment areas would be left untreated.

In terms of overall habitat quantity, Alternative S1 would reduce risk over the short term by resulting in approximately 5% more late seral forest (CWHR classes 5D, 5M, 6); however, modeling projections for year 70 indicate that the difference is negligible and for 130 years that habitat quantity under Alternative S2 is 17% higher. Similarly, canopy closure is projected to be slightly higher under Alternative S1 during the first 30 years after implementation, but Alternative S2 is expected to provide higher canopy closure after that time. Alternative S2 poses a lower long-term risk of habitat loss to wildfire. Although Alternative S2 allows greater canopy cover reduction and removal of larger trees than does Alternative S1 in the eastside pine type, these reductions/removals should not pose a significant risk to marten persistence, because martens on the eastside are generally found in the red fir and mixed conifer transition zones where fewer treatments are likely to occur.

Herger Feinstein Quincy Library Group (HFQLG) Pilot Project

Alternative S2 would allow completion of the HFQLG Pilot Project DFPZ network with retention of a minimum of 40% canopy closure in CWHR classes 5D, 5M, and 6 (outside the eastside pine type). Alternative S2 would also allow removal of trees less than 30” dbh in eastside pine habitats.

Concerns have been expressed about effects of the pilot project, particularly on marten in eastside pine habitats. Accordingly, analysis of effects on marten from the HFQLG biological evaluation and FEIS is summarized below, in the context of activities allowed under Alternative S2.

The HFQLG Pilot Project allows creation of a system of DFPZs across eastside and westside habitats. Projects within CWHR 5M, 5D, and 6 retain a minimum of 40% canopy cover. Outside of these habitat classes, there is no canopy cover retention requirement. In higher elevation habitats (primarily red fir types) where marten may be present and for which concerns for stand-replacing fire are less, greater canopy closure and more down woody debris are being left onsite where DFPZ objectives will not be compromised (Rotta, personal communication 2003). The three national forests participating in the pilot project (Lassen, Plumas, and Tahoe National Forests) have delineated corridors and areas of high quality habitat as part of a network to be managed for protection of furbearers (primarily fisher and marten). The Plumas and Tahoe National Forests have not specifically amended their plans to incorporate the networks, but the networks are considered in project planning, addressed in biological evaluations, and protected with appropriate mitigation measures. The HFQLG Pilot Project follows SAT guidelines, which require establishment of treatment buffers 200- 600' wide around streams to protect riparian areas. Riparian areas are of high importance to marten and are often used as corridors. Each proposed project area is surveyed for use by forest carnivores using standard survey methods (Zielinski and Kucera 1995).

Both historic and current detections of marten in eastside pine habitats within the pilot project area are sparse (Kucera et al.1995, Schempf and White 1977, Rotta, personal communication, USDA Forest Service Pacific Southwest Region 2002, USDA Forest Service 1999). Considering the paucity of detections, the dry open nature of eastside habitats, and the fact that a network of furbearer movement corridors embodying areas of historical detection has been established, preparers of the HFQLG biological evaluation concluded that, at the programmatic level, the proposed HFQLG management direction may affect individuals but is not likely to lead to a trend toward federal listing of this species. The majority of the established furbearer network is on the westside, where detections have been more numerous and better habitat is available.

Under Alternative S2, westside habitats are afforded greater protection in terms of canopy closure requirements for DFPZs and more habitats have been set aside for spotted owls which will also benefit marten. Corridors identified in the respective Forest's furbearer network provide connectivity to marten populations to the north and south of the HFQLG. Corridors also provide connection to suitable habitats and areas with historic detections on the eastside of the HFQLG Pilot Project area. There are no significant populations further to the east that would make connectivity through eastside habitats of great importance.

Concerns have also been expressed regarding group selection in the HFQLG Pilot Project area under Alternative S2 and the potential effects on marten. The HFQLG Act directed that group selection harvest be conducted over 0.57% of the pilot project area per year for 5 years. Further legislation allowed extension of the pilot project. Group selection units are to be 0.25 to 2 acres in size. Alternative S1 allows implementation of about 4,000 acres/year of group selection under an administrative study of effects on spotted owls. Alternative S2 allows implementation of group selection on 8,700 acres/year and allows DFPZ construction in LSOG areas ranked 4 and 5, as long as old forest patches are avoided and 40% canopy cover is retained. After the legislative extension expires, the pilot project area would be managed the same as the rest of the SNFPA planning area, pending forest plan revision.

The size of the proposed group selection units are within the size range of openings used by marten, if suitable shrub and down log cover is available. Over the five year period, group selection units would affect approximately 2.5% of the available landbase. Together with DFPZ construction and thinning of other areas, a larger portion of suitable marten habitat would be affected but generally not rendered unsuitable for foraging or dispersal. The forest carnivore network, riparian corridors, and spotted owl habitat allocations would provide a base level of interconnected high quality habitats. Based on the limited life of the pilot project and proposed mitigations that include retention of a minimum of 40% canopy closure (in CWHR classes 5D, 5M, and 6 for DFPZs) and avoidance of old forest patches within LSOG habitat ranked 4 or 5, the project may affect individuals but would not create a trend leading to federal listing under the Endangered Species Act.

Cumulative Effects

Habitat

Suitable habitats for marten are currently either broadly distributed or highly abundant across the range of the species. However, temporary gaps exist where suitable environments are absent or only present in low abundance. Disjunct areas of suitable environments are typically large enough and close enough to permit dispersal and interaction among subpopulations across the species range. Alternative S1 and Alternative S2 would lead to improvements over time. Despite some gaps, the combination of distribution and abundance of environmental conditions would provide opportunities for nearly continuous intraspecific interactions.

Alternative S2 would involve more intensive treatments at local scales compared to Alternative S1, which may lead to a greater risk to important marten habitat components, including canopy closure, large tree density, snag and down log recruitment, and multi-storied structural diversity. Alternative S1 would provide greater protection for existing late-seral habitats. However, in the context of the broad planning area, Alternative S2 would result in little overall change in marten habitat compared to Alternative S1. This conclusion is based on the assumption that the strategic pattern of treatments would not involve more than approximately 25%-30% of the landscape and that red fir types would not generally be subjected to fuels treatments.

Population

The current combination of habitat and population conditions provides the opportunity for marten to be broadly distributed and highly abundant across the species range, with potential gaps where populations may be absent. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and to allow the species to interact as a metapopulation across its historical range.

Alternative S1 and S2 would be expected to result in a broad distribution of marten within the planning area.

4.3.2.3. California Spotted Owl

Factors Used to Assess Environmental Consequences

Effects both to the planning area and specific to the HFQLG Pilot Project are addressed for each factor.

1. Distribution of owl sites among land allocations

Measure: proportion of owl sites occurring in land allocations where vegetation treatments are limited

2. Provisions for protection of known or potential nest stands

Measures: survey requirements, proportion of California spotted owl breeding territories protected, size and configuration of PACs, management within PACs

3. Provisions for habitat abundance at the landscape and home range scales

Measures: modeled changes in habitat abundance, amount of habitat provided in owl home ranges, amount of habitat provided within owl home ranges in geographic areas of concern, effects on habitat suitability for selected prey species of the California spotted owl

4. Levels and types of forest management activities

Measures: acreage of vegetation treatments, fragmentation effects resulting from vegetation treatments, location of vegetation treatments in relation to geographic areas of concern

5. Standards and guidelines addressing important elements of habitat quality

Measures: canopy cover and structure; large, old trees; snags and down wood; retention of duff layer

6. Level of natural disturbance

Measure: change in the amount of area affected by stand replacing wildfires

Analysis Assumptions and Limitations

The factors used to assess the effects of Alternatives S1 and S2 on the California spotted owl are the same as those used in the FEIS.

All estimates used in this analysis were derived from habitat modeling based on Vestra vegetation typing converted to CWHR classes. See Appendix B for information on the habitat monitoring methods. References to California spotted owl PACs are based on current owl numbers and the mapped distribution of the associated PACs.

The primary differences in the standards and guidelines pertaining to California spotted owl habitat for Alternatives S1 and S2 are identified in Table 4.3.2.3a.

Table 4.3.2.3a. Standards and Guidelines for Mechanical Treatments – A Generalized Comparison.

Variable	Alternative S1	Alternative S2	Alternative S2 - HFQLG
Canopy retention	If canopy cover is 40-50%, remove trees less than 6” dbh. If canopy cover is 50-59%, retain at least 50%.	Goal – retain 50% canopy cover. Minimum - retain 40% canopy cover. Retain minimum of 5% of the post-treatment canopy in trees 6-24” dbh.	Retain minimum of 5% of the post-treatment canopy in trees 6-24” dbh in 5m, 5D & 6, no minimum in 4M, 4D.
Canopy reduction	Up to 10-20% canopy reduction in dominant and co-dominant trees.	Up to 30% canopy reduction.	Up to 30% canopy reduction in CWHR 5M,5D, 6: no minimum in CWHR 4M, 4D.
Area of stand to leave untreated within treatment unit boundary	Leave 10% in defense zone, 15% in threat zone, 25% in general Forest and OFEA.		
Diameter limits	Depending on land allocation and CWHR type of affected stand, diamter limits of 6”, 12”, or 20” dbh are imposed. For all land allocations, retain trees ≥30” dbh.	Retain minimum 40% basal area generally comprised of the largest trees. Retain trees larger than ≥30” dbh .	Retain trees ≥30” dbh. Retain minimum 30% basal area in CWHR 4M,4D; 40% basal area in CWHR 5M, 5D, 6.
Eastside pine	Maintain 30% canopy cover. Retain trees ≥24” dbh.	Maintain minimum 30% basal area. Retain trees ≥30” dbh. No canopy cover retention standards.	Maintain minimum 30% basal area. Retain trees ≥30” dbh. No canopy cover retention standards.
Affected PACs	Treatments intersect with no more than 5% of the number of PACs per year and 10% of the number of PACs per decade.	Treatments intersect with no more than 5% of PAC acreage per year and 10% of PAC acreage per decade.	PACs (including SOHAs) excluded from treatment for life of pilot project, except for light underburning.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 82-112.

Distribution of Owl Sites among Land Allocations

Summary Observations

- In alternatives S1 and S2, 15% of PACs overlap with the defense zone.
- In alternatives S1 and S2, 19% of PACs overlap with the threat zone.
- In alternatives S1 and S2, 80% of HRCA acreage is not projected to be treated.
- In alternatives S1 and S2, 86% of OFEA acreage is not projected to be treated.
- Under Alternative S1, portions of 20% of all PACS are projected to be treated. Under Alternative S2, portions of 26% of all PACs are projected to be treated.

Based on records from the California Department of Fish and Game recorded through 2002, a total of 1,321 owl sites are known on Forest Service lands within the project area, with another 129 sites reported on non-Forest Service lands within the boundaries of the project area. The Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests have the highest concentration of spotted owls. Within the Sierra Nevada region, these forests contain 99 percent of the total known owl sites on Forest Service lands (USDA Forest Service, Pacific Southwest Region 2001a).

California spotted owls are currently distributed relatively continuously and uniformly throughout their range in the Sierra Nevada (Verner et al. 1992, Noon and McKelvey 1996), although concern exists for fragmentation effects at finer scales due to habitat alteration (Gutierrez and Harrison 1996). At the landscape scale, the intent of a conservation strategy is to provide for sufficient amounts and distribution of high quality habitat to facilitate natal and breeding dispersal among territories and to maintain California spotted owls well-distributed throughout their historic range in the Sierra Nevada. Protecting occupied, as well as suitable but unoccupied habitat, over the long term is important at this scale. The response of California spotted owls to vegetation treatments remains largely unstudied (Verner et al., 1992).

Both alternatives includes two large land allocations as part of their overall strategy for conserving old forest ecosystems and species associated with those ecosystems: old forest emphasis areas (OFEAs) and California spotted owl home range core areas (HRCAs). These land allocations are managed under standards and guidelines specific to each alternative.

Treatments are projected to occur on roughly the same number of acres of HRCAs and OFEAs under both Alternative S1 and S2 (Table 4.3.2.3b). However, the standards and guidelines in Alternative S1 limit vegetation treatments in these areas to light thinning prescriptions (generally removing trees less than 12” dbh) to reduce hazardous fuels. This alternative also uses prescribed fire as the initial treatment on more acres.

Alternative S2 would include an active management approach to move landscapes toward desired conditions. Landscape level desired conditions would be used, along with standards and guidelines, to develop fuels treatment prescriptions and determine management intensity within treated areas. Where consistent with the desired condition for the underlying land allocation, prescriptions would be designed to reduce hazardous fuels, to address local forest health issues, and to help defray the costs of fuels treatments.

Under Alternative S2, mature forest stands (CWHR classes 4M, 4D, 5M, 5D, and 6) in OFEAs and HRCAs would be managed under forest-wide standards and guidelines for mechanical thinning. Under this alternative, the standards and guidelines would provide sideboards for project-level planning. Across the bioregion, managers would generally be directed to retain medium and large live conifers (trees ≥30” dbh), at least 40% of existing basal area comprised of the largest trees, and at least 40% canopy cover (unless treatment of ladder fuels results in lower levels of canopy cover). The management intent for mechanical thinning in mature forest habitat outside the WUI defense zone would be to: 1) maintain and develop old forest habitat conditions by leaving the largest trees; 2) ensure recruitment of very large trees across the landscape; 3) balance the need to provide understory structure with the need to reduce fuel ladder and crown fuels; 4) maintain high levels of canopy cover whenever it is possible to do so and still meet fuels objectives; 5) maintain stands at or near 40% canopy cover in a condition that provides dispersal and foraging habitat while allowing effective fuels treatments; and 6) avoid large changes in canopy cover.

Table 4.3.2.3b. Acres of HRCAs/OFEAs treated by Year 20*

	HRCA			OFEA		
Alternative	**Total HRCA Acres in Bioregion**	**Total Treated**	**Percent Treated**	**Total OFEA Acres in Bioregion**	**Total Treated**	**Percent Treated**
S1	1,047,858	210,745	20.1%	3,165,999	430,214	13.6%
S2	1,047,858	212,428	20.2%	3,165,999	442,881	14.0%

**Acres of HRCA and OFEA overlap. (Source: USDA Forest Service, Pacific Southwest Region 2003i.)*

Under Alternative S1, standards and guidelines applicable across the planning area for conservation of California spotted owls would generally be applied to the HFQLG Pilot Project Area. Resource management activities, as defined in the Act, would not be conducted in offbase and deferred lands (466,433 acres), California spotted owl PACs (411), and California spotted owl habitat areas (SOHAs). Consistent with the management direction in the HFQLG Forest Recovery Act FEIS, resource management activities would also not occur in LSOG classes 4 and 5 (USDA Forest Service 1999).

Under Alternative S2, resource management activities, as defined in the Act, would not be conducted within the land allocations noted above (offbase and deferred lands, spotted owl PACs, and SOHAs). However, under Alternative S2, DFPZs could be constructed within the LSOG classes 4 and 5 land allocation outside of stands classified as CWHR types 5M, 5D, and 6. After the pilot project is completed, the standards and guidelines for the rest of the bioregion would be applied to the HFQLG Pilot Project Area, pending forest plan revision.

Provisions for Protection of Known or Potential Nest Stands

Summary Observations

- In Alternatives S1 and S2, all projects would be surveyed for owls using standardized protocols.
- In Alternatives S1 and S2, all newly discovered owl sites would be designated with 300 acre PACs.
- In Alternatives S1 and S2, treated areas are projected to overlap with 147 PACs in the defense zone.
- In Alternatives S1 and S2, treated areas are projected to overlap with 66 PACs in the threat zone. Under Alternative S1, these areas would be treated with prescribed fire. Under Alternative S2, mechanical treatments could be used.
- Under Alternative S2, treated areas are projected to overlap with 130 PACS outside the defense and threat zones (an additional 80 PACs relative to Alternative S1). These areas would be treated with prescribed fire.
- Approximately 3.6% of PAC acres would be treated under Alternative S1. This compares with 4% of PAC acres treated under Alternative S2.

- In Alternatives S1 and S2, managers are directed to avoid treatment in PACs if at all possible. It is projected that, under either alternative, over 95% of the acres within PACs will be managed to meet the desired conditions described for California spotted owl PACs.

Survey Requirements

An additional 160-220 spotted owl territories may exist on Forest Service lands within unsurveyed suitable habitat (USDA Forest Service, Pacific Southwest Region 2001a). Surveys allow for locating (and subsequently protecting) these additional owl territories. Alternatives S1 and S2 would require California spotted owl surveys to be conducted to protocol for all fuels and vegetation treatments conducted in suitable owl habitat. This requirement would also apply to resource management activities within the HFQLG Pilot Project Area.

Size and Configuration of PACs

Management direction specifying the size of PACs and delineation of habitat within PACs would be the same under both alternatives. PACs must encompass 300 acres of the best available habitat, including known and suspected nest stands, in as compact a unit as possible (Verner et al., 1992, USDA Forest Service 1993, and SNFPA FEIS ROD (2001)). Within HFQLG Pilot Project Area, PACs and 1,000-acre SOHAs would not be treated for the life of the pilot project.

Proportion of California Spotted Owl Breeding Territories Protected

Protecting owl breeding territories is important given the high temporal variability of California spotted owl reproductive rates. Owl populations may go through periodic declines with periods of non-breeding followed by breeding pulses (Verner et al. 1992:72-73). The loss of available nest sites due to catastrophic events or as a result of habitat perturbation, may preclude population expansion following breeding pulses. This in turn may result in declining populations with lower likelihood of persistence over time (USDA Forest Service, Pacific Southwest Region 2001a). In addition, PACs established for newly discovered owls protect nest sites from intensive management activity which may offset losses in nesting habitat to wildfire.

Under Alternatives S1 and S2, all known California spotted owl nest sites would be protected and PACs would be established for newly discovered sites. The 1,321 existing PACs established through 2002 would be retained and managers would be directed to avoid treating PACs to the extent possible. Further, PACs would be protected and managed as part of a conservation network unless they were rendered unsuitable by wildfire and surveys completed to protocol confirmed they were no longer occupied. This direction would also apply to the HFQLG Pilot Project Area for the life of the pilot project.

Both alternatives prohibit mechanical treatments within a 500-foot radius around owl activity centers in all land allocations. Management intent for PACs would include the protection of PACs. Where possible, the area around PACS would be treated to reduce the likelihood of habitat loss from wildfire.

Alternative S1 places limits on the *number* of PACs that can be affected by fuels treatments. Specifically, treated areas would not be allowed to intersect more than 5% of the total number of PACs within the bioregion each year (10% of PACs per decade).

Alternative S2 places limits on the *acres* of PACs that can be affected by fuels treatments. Under this alternative, the acres of fuels treatments with PACs would be limited to 5% of PAC acres in the bioregion each year (10% of PAC acres per decade).

Under Alternative S1 and S2, the 411 PACs/SOHAs within the HFQLG Pilot Project Area (including those within WUIs) would be treated only under a prescribed burning prescription specifically designed to improve the habitat suitability or integrity of the PAC. After completion of the pilot project, these PACs would be treated consistent with the standards and guidelines in effect for the rest of the bioregion.

Management within PACs

In studies referenced in Verner et al. (1992), spotted owls preferred stands with significantly greater canopy cover, total live tree basal area, basal area of hardwoods and conifers, and snag basal area, for nesting and roosting. Thus, activities that would degrade or remove any of these habitat attributes are believed to pose some level of risk to owl occupancy and production. It is uncertain whether the benefits of treating PACs to reduce their susceptibility to wildfire will outweigh the potential negative effects of the treatments on owl occupancy and habitat quality. In part, the uncertainty stems from a lack of knowledge about how different types of treatments or combinations of treatments will actually affect fire risk and severity within PACs and in areas surrounding PACs.

As previously mentioned, the alternatives would either limit the *number* of PACs that can be intersected by treatments (Alternative S1) or the *acres* of PACs that can be treated (Alternative S2). An analysis was conducted to determine the number and acreage of PACs within the bioregion that might be treated given these constraints and the objective of avoiding treatments in PACs to the extent possible. It was assumed that the WUI would have first priority for treatment.

To conduct the analysis, a model of optimum treatment patterns was compared with a map of all PACs in the bioregion to determine the degree of potential intersection with planned treatments. It was assumed that intersections of 10 acres or less could be avoided at the project level and they are not included in the summary statistics reported here. The objective of avoiding PACs was addressed by reviewing the spatial distribution of PACs. Wherever there was a high density of PACs (defines as 6 PACs clustered within a per 4,500 moving window) it was assumed that it would be impossible to avoid intersecting PACs and still maintain the integrity of the strategic pattern needed to modify fire behavior. These are the areas projected to be treated within PAC boundaries. The outcomes for both alternatives are shown in Table 4.3.2.3c and discussed below.

Defense zone. Under Alternatives S1 and S2 the same number and acres of PACs in the defense zone are projected to be treated. Mechanical treatments are allowed under both alternatives. As a result, stand structure within portions of 147 PACs in the defense zone could be simplified by removing ladder and surface fuels, potentially reducing the quality of owl habitat within the PAC.

Threat zone. The same number and acres of PACs in the defense zone are projected to be treated under Alternative S1 and S2. Under Alternative S1, only prescribed burning is allowed. Alternative S2 allows these intersections to be mechanically treated while meeting the desired conditions and intent of minimizing habitat disturbance within the PAC. The practical difference between the alternatives is that under Alternative S1, a prescribed underburn would be used in the treated area. Under Alternative S2, the same area would receive a light mechanical treatment followed by a prescribed burn.

Wildlands (area outside WUI). Assuming the WUI has first priority for treatment, the standards and guidelines for Alternative S1 limit the number of PAC intersections that can be treated outside this zone (50). Alternative S2 allows for all unavoidable PAC intersections to be treated (130). Thus, Alternative S2 is projected to result in 80 more PAC intersections being treated. Under both alternatives, treatment options outside the WUI are limited to prescribed fire (allowing for hand treatment in the immediate vicinity of the owl activity center).

Overall, the analysis indicates that, under Alternative S1, an estimated 3.6% (15,185 acres) of PAC acres would be treated within 20% (263) of existing PACs. Under Alternative S2, an estimated 4% (17,127 acres) of PAC acres would be treated within 26% (343) of existing PACs.

Table 4.3.2.3c. California Spotted Owl PACs That Could Be Treated Within 20 Years.

Land Allocation	#PACs treated S1	Acres PAC treated S1	#PACs Treated S2	Acres PAC Treated S2
Defense	147	8,624	147	8,624
Threat	66	5,513	66	5,513
Outside WUI	50	1,048	130	2,990
Total	263	15,185	343	17,127
%	20%	3.6%	26%	4%

(Source: USDA Forest Service, Pacific Southwest Region 2003i.)

Alternatives S1 and S2 would provide the same level of protection for California spotted owl activity centers within PACs. Mechanical treatments would be prohibited within a 500-foot radius buffer around each activity center. Prescribed burning would be allowed within the 500-foot buffer. Prior to burning, managers could conduct hand treatments, including the cutting of small trees, within the 1-2 acre area surrounding nest trees.

The primary intent for treatments within PACs is to meet fuels objectives. The risk of losing PACs to high-severity fire varies considerably among PACs. The annual rate of loss has been approximately 0.2% of the PACs/SOHAs within the Sierra Nevada over the past 8 years, which equates to approximately 2.5 PACs per year. Over the last 4 years (1998 to 2002) the annual rate of loss has apparently increased to 0.34% of PACs, or an approximate average annual loss of 4.5 PACs (see Chapter 3). The pace and intensity of mechanical thinning planned under Alternative S2 is expected to reduce the rate at which habitat within PACs and SOHAs is lost to wildfire.

The numbers above are approximations. Within the limits imposed by the standards and guidelines, it is not known how many PACs or PAC acres will actually be treated in a given year. Thus, there is still some uncertainty as to the potential temporal changes to owl sites across the bioregion. In general, it is anticipated that the National Forests within the Sierra Nevada would concentrate fuels reduction treatments within the WUI during the initial period of implementation. Consequently, PACs located within the defense zone would likely be impacted within the first few years of the planning period, followed by PACs within the threat zone. However, activities could occur within the WUI and outside the WUI during the same planning period. Under both alternatives, PACs within the defense zone would potentially incur the most habitat alteration. Thus the largest impact to spotted owl PACs would occur within the first few years of S1 and S2 implementation, while the majority of PAC intersections outside the WUI would likely be treated later in the planning cycle.

Within the HFQLG Pilot Project Area, under both alternatives, vegetation and fuels treatments would not be conducted within PACs during the life of the pilot project, with the exception of light underburning to enhance habitat suitability.

Provisions for Habitat Abundance at the Landscape and Home Range Scales

Projected changes in CWHR Class Abundance - Summary Observations

- Under Alternative S1 and S2, projected changes in habitat abundance (20-50 years) show short-term decreases in CWHR classes 4M and 4D, but longer term cumulative increases in all CWHR suitable habitat types.
- Under both alternatives, 80% of the acres within HRCAs are not treated.
- Treated areas in PACs/HRCAs within areas of concern (AOCs) would be designed and addressed at the National Forest or District Ranger level.

Selected prey species

Six major studies (Verner et al. 1992, Chapter 5) described habitat relations of the spotted owl in four general areas spanning the length of the Sierra Nevada. These studies examined owl habitat use at three scales: landscape; home range scale; and nest, roost and foraging stands. Researchers determined that owls preferentially used areas with at least 70% canopy cover, used areas with 40-69% canopy cover in proportion to their availability, and spent less time in areas with less than 40% canopy cover than might be expected.

Descriptions of spotted owl nesting, roosting and foraging habitat have been developed using timber strata types (Verner et al. 1992), and more recently, CWHR classes (USDA Forest Service, Pacific Southwest Region 2001a). Recent analysis by Hunsaker et al. (2002) found that owl productivity was positively correlated with the proportion of individual owl home ranges having greater than 50% canopy cover and negatively correlated with the proportion having less than 50% canopy cover, based on aerial photo interpretation. From these correlations the authors concluded that the threshold between canopy cover values that contribute to or detract from occurrence and productivity is a value near 50%.

Based on the above studies, suitable owl habitat, as described using CWHR classification, is identified as 4M, 4D, 5M, 5D and 6 in mixed conifer, red fir, ponderosa pine/hardwood, foothill riparian/hardwood, and the east side pine forest (USDA Forest Service, Pacific Southwest Region 2001a). Nesting habitat is further defined as CWHR classes 5M[1], 5D and 6.

Concerns have been expressed about the reliability of habitat projections used in this analysis and the deterministic nature of the models that underlie those projections.

The Forest Service uses state-of-the-art analytical models for forest planning. Earlier versions of these models have been used in support of the Northwest Forest Plan and every national forest plan in the Region. The same modeling techniques were used to project the effects of management actions on threatened and endangered species, including the northern spotted owl. The models are based on thousands of measured trees, are grounded in forestry science and are uniquely developed to cover the major forested areas around the country. After many years of application, development and refinement, they are uniquely suited to projecting changes in forest growth and development over time.

Long-term projections (130) years are required under the National Forest Management Act and are fundamental to forestry science. It is recognized that, over a span of several decades, there are likely to be subsequent revisions to planning efforts and unforeseen (and unpredictable) ecological events. Thus, the analysis done in support of forest planning cannot be expected to yield a precise forecast of the outcomes 50-100 years into the future. However, this analysis does inform the decision-maker about the relative performance of the different management options under a given set of assumptions. In particular, these long-term projections are useful for understanding how long-term trends in key outputs may be influenced by the choice of management options. With regard to owl population persistence, the short-term effects of management activities are believed to be most relevant (Stine, pers. comm. 2003) and are highlighted in this effects analysis.

Table 4.3.2.3d shows the amount of spotted owl habitat currently existing within the bioregion. This data is based on approximately 3,000 individual FIA plots run through GAMMA Forest Vegetation Simulator and classed by Vestra Rules (see Appendix B).

[1] Because the canopy cover within the "M" class ranges from 40 to 59%, not all CWHR class 5M should be considered nesting habitat. The threshold between canopy cover values that contribute to or detract from occurrence and productivity is a value near 50% (USDA Forest Service, Pacific Southwest Region 2001a, Hunsaker et al. 2002).

Table 4.3.2.3d. Potentially Suitable Spotted Owl Habitat (acres by CWHR class) - Sierra Nevada Bioregion.

4M	4D	5M	5D	6	Total	Forested*	Percentage
1,096,788	1,140,237	757,206	166,398	954,683	4,115,312	7,372,257	55.8%
27%	28%	18.3%	4%	23.1%	100%		

**Does not include brush, shrubs, grass, and non-vegetative types. (Source: USDA Forest Service, Pacific Southwest Region 2003d)*

Habitat projections indicate that Alternative S1 would maintain more acreage of CWHR classes 4M, 4D, 5M, 5D, and 6 than Alternative S2 over the first 20 years. By year 50, Alternative S2 would result in over 176,000 more acres than S1 (Table 4.3.2.3e). Both alternatives would result in an increased cumulative acreage of these habitat types in year 20, year 50 and year 130, with Alternative S2 showing a greater increase than Alternative S1 over time.

Table 4.3.2.3e. Projected Acres of CWHR Class 4M, 4D, 5M, 5D and 6.

Alternative	Year 20	Year 50	Year 130
S1	4,667,363	4,845,373	5,106,971
S2	4,630,085	5,021,400	5,388,952
Difference (acres) between S1 and S2	-37,278	+176,027	+281,981
Percent Change	-0.80%	+3.63%	+5.52%

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Table 4.3.2.3f. Projected changes in CHWR 4M, 4D, 5M, 5D and 6 between S1 and S2 20 and 50 years out (expressed as a percentage from existing).

Alternative	CHWR 4M		CWHR 4D		CWHR 5M		CWHR 5D & 6	
	20 years	50 years	20	50	20	50	20	50
S1 Acres (MM)	1.075	.691	1.064	.775	.992	1.17	1.535	2.205
S1 % Change	-1.9%	-36.9%	-6.7%	-32%	+31%	+55%	+36.9%	+96.6%
S2 Acres (MM)	1.097	.735	1.021	.797	1.055	1.281	1.455	2.208
S2 % Change	-0.10%	-33%	-10.4%	-30%	+39%	+69%	+29.8%	+96.9%

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

The habitat model projections indicate trade-offs in habitat. There is a decrease in CWHR class 4M and 4D in the early decades under both Alternative S1 and S2 due to fuels treatments, which remove fuel ladders and open the forest canopy. However, the net result is an increase in the amount of CWHR class 5M, 5D and 6 due to retention of 30–inch dbh and larger trees, as well as release and growth of treated CWHR size class 4 stands (see table 4.3.2.3f).

For the HFQLG Area, as per the HFQLG Act, the California Spotted Owl Interim Guidelines (CASPO Guidelines) were used to develop the standards for mechanical treatments analyzed in the HFQLG Forest Recovery Act FEIS. As reported in the biological evaluation for that FEIS, constructing DFPZs and implementing group selection and individual tree harvests in the HFQLG Pilot Project Area would result in a 7% decrease in nesting habitat (CWHR types 5M, 5D, and 6) by 2007 and an 8.5% decrease in suitable habitat (CWHR types 4M, 4D, 5M, 5D, 6) by 2007. These declines in habitat were based on the desired condition described for DFPZ's in Appendix J of HFQLG FEIS. The desired condition for DFPZ's was to attain 40% canopy cover, remove fuel ladders (<6" dbh trees in the lower canopy layers) and reduce surface fuels. In addition, group selection harvest removed all trees in ½ to 2 acre patches. Note these projections were for 5 years, and the projections within Table 4.3.2.3g are for 20, 50, and 130 years.

The California spotted owl analysis in the HFQLG Forest Recovery Act FEIS and biological evaluation was based on a worst-case scenario. It was assumed that where the programmatic DFPZ layer overlapped with potentially suitable habitat (CWHR 4M, 4D, 5M, 5D, and 6) the underlying acres would become unsuitable habitat. There is some uncertainty as to whether all treatment units would be rendered unsuitable. The analysis assumed that the stands entered would be heavily treated and would be reduced to 40% canopy cover or even to a CWHR class P. Further, it was believed that many structural elements that have been linked to suitable spotted owl habitat (snags, vertical and horizontal layering, down woody debris) would be reduced below levels desirable for owl habitat. However, the spatial and temporal analysis for the HFQLG BE was limited to a 5-year program. Vegetation growth outside of DFPZs and the associated contribution to potentially suitable owl habitat was not explicitly considered. Nor was the fact that treatments would be prohibited in PACs or SOHAs.

Under Alternative S2, projections for the HFQLG Pilot Project Area indicate that 123,500 acres (8.7%) of stands currently in >50% canopy cover could be reduced to 40% canopy cover. This compares with 13,260 acres (1%) of change projected under Alternative S1. Over the longer term, (see Table 4.3.2.3g) there is a cumulative growth outside of treatment areas in both alternatives, and within and outside of HFQLG over current conditions. Acres treated to levels below 50% canopy cover would generally not be located within PACs or HRCAs.

Table 4.3.2.3g displays the updated projections for CWHR classes 4M, 4D, 5M, 5D and 6 in HFQLG Forests (Lassen, Plumas and Sierraville RD, Tahoe National Forest) and compares these changes with non-HFQLG Forests for 20, 50 and 130 years. After completion of the pilot project, changes in CWHR types within the HFQLG pilot project area should follow the trends reflected in this table.

Table 4.3.2.3g. Projected cumulative changes in CWHR 4M, 4D, 5M, 5D, 6 in HFQLG Forests and non HFQLG Forests.

Alternative	Current	Year 20	Year 50	Year 130
HFQLG* (S1)	1,583,979	1,817,203	1,713,204	1,507,157
HFQLG (S2)	1,583,979	1,751,709	1,676,121	1,470,773
Difference between S1 and S2		-65,494	-37,083	-36,384
Non-HFQLG** (S1)	2,796,933	3,150,098	3,328,265	3,554,002
Non-HFQLG (S2)	2,796,933	3,217,152	3,512,812	3,777,608
Difference (acres) between S1 and S2		+67,054	+184,547	+223,606

** Lassen, Plumas, and Sierraville RD, Tahoe NF*
*** Other Forests and Units minus HFQLG Forests. (Source: USDA Forest Service, Pacific Southwest Region 2003i)*

Within the HFQLG project area, full implementation of HFQLG under Alternative S2 is projected to result in roughly 65,000 fewer acres of suitable owl habitat in year 20 than Alternative S1. This is primarily due to: 1) implementation of group selection harvest; and 2) the fact that standards and guidelines for CWHR 4M and 4D do not have any minimum canopy cover requirement and have a 30% basal area retention standard. Also, under Alternative S2 the canopy cover in CWHR class 5M, 5D and 6 stands is more likely to drop to 40% in DFPZs.

Group selection harvest is included in the HFQLG Act to achieve a desired condition of all-age, multi-story, and fire resistant forests (USDA Forest Service 1999). The Act specified 8,700 acres of group selection each year, thus 43,500 acres of group selection was analyzed in the HFQLG FEIS. Approximately 50% of these groups (21,375 acres) were analyzed as being in owl habitat, and 50% were analyzed as occurring in eastside pine, which is not considered owl habitat in the HFQLG Pilot Project Area (USDA Forest Service 1999). Individual group size ranged from ½ acre to 2 acres, as described in Appendix E of the HFQLG FEIS.

Under Alternative S1, group selection would be carried out by implementing a case study and occur at an approximate rate of 4,000 acres per year for the life of the pilot project. Alternative S2 would include group selection acres at the rate anticipated in the Act (8,700 acres per year).

While new information indicates that California spotted owl population declines may not be as great as previously believed and are within the 95% statistical confidence limits of a stable population (Franklin et al. 2003), vegetation treatment over the short term (20 years) may introduce some unknown level of risk to the California spotted owl population. The habitat model projections indicate trade-offs in habitat: acres of CWHR types 4M and 4D decline in the early decades under both Alternatives S1 and S2 due to the projected fuels treatments, which remove fuel ladders and open the forest canopy. However, over time there is an increase in acres of CWHR class 5M, 5D and 6 due to retention of 30–inch dbh and larger trees, as well as release and growth of treated CWHR size class 4 stands.

The above discussion of changes in broad size class categories does not reflect habitat modifications that occur within the lower layers of treated stands. Alternative S2 standards and guidelines for mechanical thinning in mature forest types could result in the removal of habitat attributes that provide quality nesting and foraging habitat, i.e. smaller trees that provide the multi-aged, multi-layered component of suitable owl habitat**.** However, outside of the defense zone, managers are directed to retain 5% or more of the total post-treatment canopy in lower layers composed of trees 6 to 24”dbh within treated areas wherever possible.

Amount of Habitat Provided in Owl Home Ranges

California spotted owl occurrence and productivity appears to be significantly correlated with canopy cover composition within owl home ranges. In its Science Review, the Forest Service Pacific Southwest Research Station (1998) reviewed an analysis by Bart (1995) examining the relation between the amount of a northern spotted owl pair’s home range that is suitable habitat with productivity and survivorship. This analysis suggested that removing suitable habitat within the vicinity of a nest tended to reduce the productivity and survivorship of the resident owls, and that reproduction would drop below replacement rate at some threshold percentage of suitable habitat between 30 and 50 percent in home ranges and in larger landscapes in general. Hunsaker et al. (2002) found that owl productivity on the Sierra National Forest was positively correlated with the proportion of the analysis area (concentric circles around owl activity centers) having greater than 50% canopy-cover and negatively correlated with the proportion having less than 50% canopy cover. There is conflicting science about the effects of canopy cover reductions from fuels treatments on the California spotted owl. Lee and Irwin (in review, 2003) found that concerns about proposed fuels treatments having a negative effect, either short or long term on spotted owls through reductions in canopy cover at the landscape scale are not supported by their analysis or other published information. Other scientific viewpoints contend that the level of fuels treatments being proposed and the associated canopy cover reduction will have negative effects on the species.

Lee and Irwin also found that weather and other environmental factors appeared to play a more significant role than improvements in site quality on fledgling production. For example, the maximum expected gain in production of fledgling from improving alone is 10%. In contrast, the average production in the best years is 414% greater than the overall average. Trends in population numbers will respond far more dramatically to the frequency of good years than changes in site quality.

Alternative S1 includes specific standards and guidelines for areas known to be utilized by spotted owls, i.e. HRCAs. Within the designated 1,047,858 acres of HRCAs within the bioregion, vegetation and fuels treatments would be implemented using standards and guidelines developed for the old forest emphasis area land allocation. Standards and guidelines for mechanical fuels treatments in these areas are designed to allow fuels reduction while maintaining habitat components important for old forest species, specifically the California spotted owl (i.e. trees > 12” dbh; snags and down wood; dense canopy cover; and vertical, multi-aged layering).

Approximately 311,144 acres designated as HRCAs occur within WUI threat zones, and 42,274 acres designated as HRCA occur within the defense zone. The WUI standards and guidelines supercede standards and guidelines for HRCAs when these land allocations overlap. Under both alternatives, roughly 20% of total HRCA acres in the bioregion would be treated mechanically within the first two decades. Alternative S1 would result in suitable high-quality habitat within the most used core areas surrounding PACs, which increases the effectiveness of this habitat protection.

Alternative S2 includes specification of amounts of habitat to be designated as HRCAs using the same delineation process as S1. The standards and guidelines in this alternative allow mechanical fuels treatments while habitat components important for old forest species are maintained (i.e. trees ≥ 30” dbh; snags and down wood; canopy cover; and vertical, multi-aged layering). The vertical layering may be less than that retained under Alternative S1, due to the potential for harvest of trees less than 30” dbh after meeting the 40% basal area retention standard, particularly in stands previously treated under CASPO Guidelines.

Under Alternative S2, mature forest stands in these areas would be treated under the forestwide mechanical thinning standards and guidelines, which would remove fuel ladders and open up crown fuels, resulting in less trees per acre, in more open, less dense stands. Understory trees that are retained (5 to 24” dbh) would contribute to vertical layering and would grow to larger sizes to contribute to canopy closure and overall habitat quality.

An estimated 285,000 acres of CWHR class 6 (which provides high quality nesting habitat) would be treated under Alternative S1 and S2. Standards and guidelines for Alternative S1 result in retention of more of the key habitat components (i.e. higher canopy closure, multi-story canopy conditions, and a variety of residual tree sizes) within the treatment units. The intent of the standards and guidelines for Alternative S2 is to achieve the desired conditions for HRCAs while reducing fuel loads.

Many forested areas of the Sierra Nevada national forests are at high risk of drought-induced pest infestation. Many of these stands have a relatively high stand density index or high basal area relative to site capacity. These stand conditions are thought to provide high quality habitat for California spotted owls. Alternative S2 recognizes that protection against excessive tree mortality associated with competition, drought, fire, insects, diseases, and other disturbance agents is needed to attain sustainable forest structures at fine scales of tens or hundreds of acres. Forest pest management treatments in addition to fuels treatment areas may be developed and analyzed locally to address site-specific environmental conditions. All mechanical thinning would be consistent with the standards and guidelines for CWHR classes 4D, 4M, 5D, 5M, and 6 outside defense zones.

Under Alternative S2, special management direction would not apply to HRCAs within the HFQLG Pilot Project. HRCAs encompass approximately 290,073 acres in the pilot project area. Outside of PACs and SOHAs, offbase-deferred, and CWHR 5M, 5D and 6 within LSOGs 4 and 5, resource management activities as defined by the Act would be implemented using standards and guidelines developed for the HFQLG pilot project area. Individual tree selection and group selection would also be implemented.

Amount of Habitat Provided Within Owl Home Ranges Occurring in Geographic Areas of Concern

As described in the Verner Technical Report, several geographic areas of concern for the California spotted owl occur throughout the Sierra Nevada (Verner et al. 1992:45, 47, 48). The Technical Report described five conditions which give rise to some concern for the integrity of the California spotted owl’s range in the Sierra Nevada: 1) bottlenecks in 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. Nine areas in the Sierra Nevada were identified in the Technical Report as areas where one or more of these conditions currently limit the owl population. These areas of concern were thought to indicate potential areas where future problems may be greatest if the owl’s status in the Sierra Nevada were to deteriorate. They represent areas where management decisions may have a disproportionate potential to affect the California spotted owl population. Of particular concern are areas of checkerboard ownership and large inclusions of non-federal lands which occur on the Tahoe, Eldorado, and Stanislaus National Forests. Habitat projections in areas of checkerboard ownership are highly uncertain and the existing condition is often significantly fragmented. As a result, the risk and uncertainty associated with maintaining a well-distributed population is higher within these areas of concern.

Neither alternative includes unique management direction specific to geographic AOCs (Verner et al.1992). Alternative S1 and S2 lack assurances that vegetation treatments would not reduce the occupancy and productivity of owl sites in these areas. Alternative S1 provides a lower risk of decreasing replacement rate reproduction for owl sites within areas of concern by establishing HRCAs and implementing old forest emphasis area standards and guidelines for fuels and vegetation treatments within HRCAs. In the short-term, Alternative S2 increases risk of continued declines in owl density within areas of concern due to more intensive thinning based on application of the forest-wide standards and guidelines for mechanical treatments in mature forest stands and HRCAs. This increases the risk identified for widening gaps between habitat parcels, potentially resulting in reduced owl densities and reduction in distribution of owls and owl habitat in AOCs.

As with the majority of the AOCs identified within the Sierra Nevada, isolation and/or habitat fragmentation forms the basis for AOC designation. Three AOCs occur within the HFQLG Pilot Project Area and effects of resource management activities on these AOCs were addressed in the HFQLG FEIS (1999). AOC 1 identified on the Lassen National Forest is of concern due to the discontinuous, naturally fragmented, and poor quality habitat due to drier conditions and lava-based soils. AOC 2 is located in Northern Plumas County within the Lassen National Forest and is of concern due to the gap in known owl distribution, mainly on private lands, which if habitat is not available, north-south dispersal of owls could be impeded. AOC 3 is located in northeastern Tahoe National Forest on the Westside of the Sierraville Ranger District. The reason for concern is an area of checkerboard lands dominated by granite outcrops and red fir forests; both features guarantee low owl densities (Verner et al., 1992).

Based on the programmatic placement of DFPZs across the HFQLG project area, as modeled and described in Appendix J of the HFQLG FEIS, and including land available for group selection, the analysis of effects of HFQLG implementation suggested that owl habitat quality could be reduced in these AOCs and that the pilot project had the potential to widen gaps between habitat patches. Implementation of DFPZ's and group selection units increased the risk that management actions would create greater amounts of unsuitable habitat, increase the amount of edge, and potentially reduce habitat connectivity, thereby increasing fragmentation (USDA Forest Service 1999). Management activities which reduce population density by lowering habitat quality or increasing fragmentation would increase uncertainties associated with successful dispersal and mate finding (Blakesley and Noon, 1999). A potential for gaps in habitat would persist, due to uncertainty of future management direction on the extensive private inholdings and to the extensive DFPZ network proposed on national forest lands there (USDA Forest Service 1999; Appendix AA-X-35).

Effects on Habitat Suitability for Select Prey Species of the California Spotted Owl

Studies of many owl species confirm that whether a given pair of owls attempts to nest in a given year, and whether nest attempts are successful, are directly related to prey availability (Verner et al. 1992:74). Understanding how prey availability differs as habitat structure changes is essential to understanding how to manage spotted owl populations by providing suitable habitat for their prey (USDA Forest Service, Pacific Southwest Region 2001a).

Projected changes in overall habitat suitability scores for California spotted owls were estimated using CWHR habitat suitability index ratings (HSI) and vegetation treatment prescriptions and are documented in the SNFPA FEIS Chapter 3, part 4.4 page 94-95. For this SEIS, comparative CWHR habitat suitability ratings were generated for Alternatives S1 and S2. Under Alternative S1, the HSI increased for 82% of the analyzed prey species, while under Alternative S2, HSI increased for 71% of the analyzed prey species for up to 50 years.

The effects of the two alternatives on the northern flying squirrel and the dusky footed woodrat, two prey species identified in various studies as being important to the diet of spotted owls (in Verner et.al, 1992:65, 69), were compared using CWHR habitat suitability index ratings and habitat modeling. Habitat modeling for the northern flying squirrel indicates that Alternative S2 would result in 25,069 more acres of northern flying squirrel habitat at the end of 20 years than would Alternative S1, while Alternative S2 would result in more habitat over the long term (152,914 acre increase at the end of 130 years). Habitat modeling for dusky footed woodrat indicates that Alternative S2 would result in 23,778 more acres of woodrat habitat at the end of 20 years than would Alternative S1, but Alternative S1 would result in more habitat over the long term (25,979 acres more at the end of 130 years). Available habitat for populations of both species would apparently increase slightly over current conditions. The difference in projected habitat and associated prey species populations between the alternatives in either the short- or long-term would be very small.

Levels and Types of Forest Management Activities

Acres of Mechanical Vegetation Treatment - Summary Observations

- Within PACs, HRCAs and OFEAs, Alternative S2 treats 16,291 more acres than Alternative S1.
- Proposed treatments under Alternative S2 are not expected to increase fragmentation above the level expected under Alternative S1, as all treatments maintain at least 40% canopy cover and large trees. The amount of group selection within HFQLG area increases from 4,000 acres per year to 8,700 acres per year under Alternative S2. As a result, some additional stand scale openings are anticipated under this alternative.
- Neither alternative includes unique management direction specific to geographic areas of concern.

Alternative S1 would involve implementation of mechanical vegetative treatments on an estimated 51,345 acres per year across the Sierra Nevada landscape, including group selection and construction of DFPZs in the HFQLG Pilot Project Area. Alternative S2 would involve implementation of vegetation and fuels treatments on approximately 72,200 acres annually, including activities in the HFQLG Pilot Project Area.

Vegetative treatments within OFEAs indicate that the potential for change due to mechanical treatments is greatest under Alternative S2 (Table 4.3.2.3h). Alternative S2 is projected to mechanically treat an additional 225,412 acres relative to Alternative S1. Considering all treatment methods, it is estimated that 12,667 more acres of OFEA would be treated under Alternative S2.

All vegetation treatments, from prescribed fire to group selection are designed to affect stand structure that reduce fuel loads and reduce the risk of high severity wildfire and would in turn affect habitat suitability for owls. More intensive vegetation treatments (heavy thinnings and group selection) have a high or moderate likelihood of changing suitable habitat to potentially unsuitable habitat. Under these treatments more structural elements and combination of elements important to owls are modified and removed.

Table 4.3.2.3h. Acres Treated in Old Forest Emphasis Areas.

Alternative	Mechanical thin	Prescribed burn	Total
S1	135,122	295,093 (69%)	430,214
S2	360,543	82,339 (19%)	442,881
Difference between S1 & S2	225,421 more acres with S2	212,754 less acres with S2	12,667 more acres OFEA treated with S2

Fragmentation Effects Resulting from Vegetation Treatments

Vegetation treatments that create openings or reduce suitable habitat will widen the gaps between habitat patches. Increases in the amount of discontinuous habitat and isolation of habitat patches are concerns within known owl home ranges as well as across the landscape. A reduction in continuity of habitat between owl activity centers, including the habitat outside known owl home ranges, could limit successful mate finding and dispersal, increasing nearest neighbor distances and affecting population trends (Verner et al., 1992, Blakesly and Noon 1999, USDA Forest Service 1999).

Vegetation and fuels treatments under Alternative S1 would not create habitat gaps and would be unlikely to contribute to discontinuous habitat and isolation of subpopulations (SNFPA FEIS chapter 3, part 4.4 page 97). Standards and guidelines for Alternative S1 would explicitly limit the extent to which canopy cover and structure could be reduced. The more intensive vegetation treatments, outside of HRCAs and PACs, under Alternative S2 are more likely to reduce canopy cover to 40% on approximately 8% of acres treated currently at 50% canopy cover or greater, and potentially affecting habitat suitability. However, the overall increase of suitable habitat predicted for both Alternatives S1 and S2 by year 20 of treatment, and the overall habitat increase over time (Year 50 and year 130, Table 4.3.2.3e), indicate that treatment prescriptions for both Alternatives S1 and S2 would contribute to increasing amounts of suitable habitat. The group selection units within the HFQLG Pilot Project Area, in conjunction with placement of DFPZs, could lead to increases in habitat fragmentation by 2009 (USDA Forest Service 1999).

Location of Vegetation Treatments in Relation to Geographic Areas of Concern

To the extent that treatments are concentrated (either in space or time), particularly within certain geographic areas of concern identified in Verner et al., (1992, page 45-47), the overall impacts of the actions upon spotted owl populations may be increased.

Table 4.4.2.1k within Volume 3, Chapter 3, part 4.4, page 99 in the SNFPA FEIS shows the number of PACs that occur within the WUI, by geographic area of concern. This table was based on 1315 PACs, not 1,321; it is presumed that these six additional PACs would not change the proportional distribution shown in this table. Approximately 81% of all PACs are located outside of the AOC's. The location of vegetation treatments would be the same under Alternatives S1 and S2. Vegetation treatments occurring in owl activity centers within the defense zone under Alternative S1 and S2 may not be maintained through time, given potential fuels treatment prescriptions. This accounts for approximately 11 PACs within AOCs. The 52 PACs within the threat zone located in AOCs would experience subtle changes in habitat conditions under S1, and it would not be expected to result in lower owl densities or lower productivity in owl sites (SNFPA FEIS, 2001, Volume 3, Chapter 3, part 4.4, page 99). Vegetation treatments with S2 within these 52 PACs would be designed with the intent to meet the desired conditions for owl habitat as described earlier.

AOC 5 located on the Stanislaus National Forest and AOC 7 located on the Sierra National Forest have a high proportion (greater than 70%) of owl sites occurring within the urban intermix (WUI) zone, and are therefore likely to be at risk to impacts from vegetation treatments. Areas of concern 3, 4, and 8 have more than a quarter of the known owl activity centers within the urban intermix zone.

Eighteen PACs are located in AOCs in the HFQLG Pilot Project Area. These PACs will not be entered for treatment of vegetation until the completion of the pilot project in 2009, when forest-wide standards and guidelines for mechanical thinning treatments in mature forest stands within area treatments (in WUI threat zones and wildlands) and direction for treating defense zones become effective. Under Alternative S2, implementation of group selection within the HFQLG Pilot Project Area, in conjunction with placement of DFPZs, could increase the likelihood of fragmentation in three AOCs by 2009. The AOC 1 on the Lassen National Forest contains one owl PAC, AOC 2 on the Lassen/Plumas National Forest contains 4 PACs and AOC 3 is only partially located on the Sierraville Ranger District, and contains 13 PACs

Standards and Guidelines for Important Elements of Habitat Quality

Summary Observations

- Alternative S2 allows mechanical treatment on approximately 265,661 more acres than Alternative S1. This figure includes acres that would have been treated with prescribed burns under Alternative S1 within PACs, HRCAs, and OFEAs.
- Treated acres within PACs, HRCAs, and OFEA in Alternative S1 are projected to be 44% mechanical treatments and 56% prescribed burning.
- Treated acres within PACs, HRCAs, and OFEA in Alternative S2 are projected to be 83% mechanical treatments and 17% prescribed burning.
- Across the bioregion, large old trees would increase under both alternatives; Alternative S2 increases the amount of large trees in 20 years by 1.5% and 3.8% in 50 years.
- Across the bioregion, at least 5 snags per acre are projected to exist in all decades. This meets/exceeds the desired condition for this habitat component.

Canopy Cover and Structure

Studies by Verner et al. (1992), and Hunsaker et al. (2002) have identified canopy cover and layering as stand structural characteristics associated with preferred nesting and foraging sites for the California spotted owl. Hunsaker et al. (2002) concluded that the threshold between canopy cover values that contribute to or detract from occurrence and productivity of California spotted owls is a value near 50 percent (measured through aerial photo interpretation). Structure would be defined as multiple layers, species composition, and age classes. The Technical Report (Verner et al. 1992: Chapter 4) suggests these structural components may contribute to a greater diversity of prey species, may provide a variety of owl perch sites for increased hunting opportunities, may provide variable microclimates for more comfortable roost sites, or may increase protection from predators.

There are many methods of calculating canopy cover, such as 1) Aerial Photo Interpretation, 2) Spherical Densiometer, 3) FIA plot data, 4) “Moosehorn” Vertical Sighting Device, 5) Simplified Vertical Sighting Tube, and others. Each of these methods has advantages and disadvantages, and each has their own error rate. It is the intent of this EIS that whatever method of measuring canopy cover is used, that the limitations and potential error rate of that method will be considered in the determination of canopy cover at the project level

Under Alternative S1, all vegetation treatments in westside habitats would maintain a minimum of 50% canopy cover where it currently exists, which would retain suitable canopy cover for owl habitat both within and outside of spotted owl home ranges. Vegetation treatments would maintain a minimum of 30% basal area retention in eastside pine type; there is no canopy requirement in eastside pine. Standards and guidelines for Alternative S1 limit reduction of canopy cover reduction to 10% in OFEAs and HRCAs, and to 20% in general forest. Under Alternative S1, existing patches of CWHR classes 5D, 5M and 6 that are larger than one acre in size would be maintained.

Alternative S2 includes a goal of maintaining a minimum of 50% canopy cover in all allocations, allowing for a reduction to 40% where the 50% goal cannot be met. Canopy cover can be reduced by no more than 30% from the existing condition. Alternative S2 contains a retention standard of 5% in trees 6” – 24” dbh that would contribute to structural layering. The DFPZs created in the HFQLG pilot project would target a desired condition of 40% canopy cover. Within the HFQLG Pilot Project Area, CWHR classes 5D, 5M, and 6 stands within LSOGs 4 and 5 would not be subjected to resource management activities (i.e., DFPZ construction, individual tree selection, or group selection).

Habitat modeling indicates that about 0.4% more canopy cover would be maintained for the first three decades under Alternative S1 than under Alternative S2. After the third decade, slightly higher canopy cover would be maintained under Alternative S2 (1% vs. 2%).

Table 4.3.2.3i. Acres Projected to be treated by Treatment Type and Alternative.

	Alternative S1			Alternative S2			
	Mechanical Treatment	**RX Burn Only**	**Total Acres**	**Mechanical Treatment**	**RX Burn Only**	**Total Acres**	**Difference Between S1 & S2**
PAC Acres Potentially Treated	8,141	7,044	15,185	13,586	3,540	17,127	1,942 (more acres in S2)
HRCA Acres Potentially Treated	149,589	61,156	210,745	184,384	28,044	212,428	1,683 (more acres in S2)
OFEA Acres Potentially Treated	135,122	295,093	430,214	360,543	82,339	442,882	12,667 (more acres in S2)
Total Acres Treated	**292,852**	**363,293**	**656,145**	**558,513**	**113,923**	**672,436**	**16,291 (more acres in S2)**

Note: PAC acres are included with the HRCA acres, and OFEA acres include some HRCA acres. Therefore some acres are double counted within this table. This table is for comparison only. Total HRCA acres within bioregion 1,047,858 and total OFEA acres within bioregion 3,165,999. (Source: USDA Forest Service, Pacific Southwest Region 2003d).

Mechanical thinning has a greater potential to reduce the canopy cover and structure more than light underburning. Because more acres are projected to be mechanically treated under Alternative S2, this alternative is likely to have a greater effect on stand structure (down logs, snags, canopy layering, duff layer and tree density) within treated areas.

Large, Old Trees

Large, old trees are preferentially selected for nest sites by spotted owls (Verner et al. 1992; Chapter 5). Data within this Technical Report showed nest trees averaged greater than 40 inches d.b.h., and were much larger than the mean diameter of trees generally available. Two-thirds of the nests were in large, natural cavities formed by decay at sites where branches broke off or tore out of the trunk of the tree, and another 20 percent were on broken tops of living or dead trees, or on dwarf mistletoe brooms. As large old trees decay and die, they contribute to large snags and downed woody debris.

Both alternatives would involve retention of trees ≥ 30” dbh in westside forests. In eastside types, under Alternative S1, all trees ≥24” would be retained; under Alternative S2 all trees ≥30” would be retained. Alternatives would differ in the stand-level retention standards, which would affect recruitment and density of large trees over time. Under Alternative S1, all trees would be retained ≥12” dbh in old forest emphasis areas and ≥20” dbh in general forest land allocations where understories are thinned (but large trees could be removed to facilitate operations). This guideline specifically requires retention of the 20–30” size class for future recruitment of large trees.

Alternative S2 would involve a different strategy for large tree recruitment. Large tree recruitment would be achieved by retaining all trees ≥ 30” dbh, a minimum of 40% of existing basal area in the form of the largest trees within treated areas, a goal of not less than 50% canopy cover, and retention of a minimum of 5% of the post-treatment canopy cover in 6-24” dbh trees. These standards are expected to maintain the largest trees in the affected stands, while allowing for some vertical complexity and maintenance of the minimum canopy requirements identified as important for owls (Hunsaker et al. 2002).

Modeling projects a general increase in large tree availability, in terms of numbers of large tree availability across the bioregion. Compared with S1, Alternative S2 would result in approximately 1.5% more large trees after 20 years, a 3.8% increase after 50 years, and a 9.2% increase by 130 years.

Snags and Down Wood

Spotted owls occasionally select snags for nest sites, either broken topped or in natural cavities in the snag. Of the 263 nests reported from conifer forests, 17 percent were in snags (Verner et al., 1992:72). Snags provide nesting and denning habitat for spotted owl prey, such as squirrels and woodpeckers. Of significance to the spotted owl, the flying squirrel, a primary prey species in conifer forests, often use old woodpecker cavities (Ibid). Snags eventually fall and contribute to the accumulation of decaying wood on the ground, which indirectly benefits the owl (Ibid).

Both alternatives are projected to retain a number of snags ≥15"dbh in the general forest allocation and are projected to retain at least five snags per acre in all decades. In addition, Alternative S1 requires all snags ≥ 15" dbh to be retained in HRCAs and OFEAs. Under each alternative, the direction for managing snags within the HFQLG Pilot Project area is the same as the rest of the bioregion.

Alternative S1 and S2 have essentially the same standards and guidelines for retention of large woody debris.

Retention of Duff Layer

As summarized in the Technical Report (Verner et al. 1992:71) management practices that decrease the soil organic layer could affect the production of hypogeous fungi, a major food source for northern flying squirrels and white-footed mice. Both are important prey species of the California spotted owl. Trees also depend on fungi for an adequate intake of various nutrients, thereby increasing the fitness of the forest. The reduction of the soil organic layer within a stand could affect the biological diversity of that stand.

As stated in the FEIS SNFPA Chapter 3 part 4.4 page 102, all alternatives meet regional soil quality standards. An assumption was made that the more areas treated with mechanical treatments, the greater the potential for disturbance of the duff layer and associated micro-habitat that may be important to spotted owl prey. Mechanical treatments involve the use of heavy machinery that increase the potential for soil disturbance, including displacement and compaction, especially in the first few inches that include the organic duff layer.

As shown in Table 4.3.2.3i, mechanical treatment in HRCAs and PACs would occur on an estimated 292,852 acres under Alternative S1 compared with 558,513 acres under Alternative S2. Thus, Alternative S2 would increase the potential for disturbance of duff layers and associated micro-habitats that may be important to spotted owl prey. However, both alternatives adopt the same objective and standards and guidelines for maintaining long-term soil productivity. Impacts to soil quality have been determined to be similar for both alternatives (USDA Forest Service Pacific Southwest Region 2003h).

Level of Disturbance Including Change in Area Affected by Stand Replacement Fire

Summary Observations

- It is estimated, based on the last 4 years of actual data, that 63,000 acres/year would be burned by wildfire, and that this would be reduced under Alternative S2 by 22% in year 50.

Wildfire effects, particularly those associated with large, stand replacing wildfires, are a major source of risk to spotted owl populations. Loss and degradation of habitat, creation of habitat gaps, and lengthy time periods for habitat reestablishment, are some of the impacts that may result from wildfire. Alternatives that are projected to reduce the acreage and/or intensity of wildfires would be expected to provide long-term benefits to spotted owls.

Over the last 30 years the Sierra Nevada has averaged about 43,000 acres of wildfire/year. In the last 10 years the average has increased to about 63,000 acres per year. It will take at least two decades of fuels treatments before significant changes in wildfire behavior are achieved (USDA Forest Service, Pacific Southwest Region 2001a). Analysis results indicate that Alternative S2 would result in less wildfire acres by the fifth decade (Table 4.3.2.3j), thus a potential subsequent decreased loss of spotted owl habitat due to wildfire is expected. Approximately 25% of the total acres burned are projected to be high intensity fires.

Table 4.3.2.3j. Annual acres of wildfire by alternative.

	Alternative S1	Alternative S2
Annual acres of wildfire, first decade	64,000	60,000
Annual acres of wildfire, fifth decade	63,000	49,000
Percent change in annual wildfire acres from first decade to fifth decade	-2%	-22%

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Cumulative Effects

Table 4.3.2.3k. Potential Cumulative Effects of Alternatives, Short Term (20 years).

ACTION	Total in Bioregion	Potential Cumulative Effect Under S1	Potential Cumulative Effect Under S2	Changes as a result of S2
PAC Acres	421,780 acres	15,185 treated	17,127 treated	1,942 more acres
Number of PACs	1,321*	263 intersected	343 intersected	80 more PAC's intersected
HRCA Acres	1,047,858	210,745 treated	212,428 treated	1,683 more acres
Suitable Habitat Acres (4M, 4D, 5M, 5D, 6)	4,115,312	4,667,363**	4,630,085**	37,278 less acres
Suitable Nesting Habitat (5M, 5D, 6)	1,878,287	2,527,416**	2,510,394**	17,022 less acres
OFEA Acres Treated	3,165,999	430,214 treated	442,881 treated	12,667 more acres
Acres Wildfire	63,000/year	1,260,000 burned	1,260,000 burned	
PACs lost to wildfire	4.5/year	±90 PACs lost	±90 PACs lost	

** may increase over 20 years due to surveys ** may be less due to wildfire*

Habitat

Under Alternatives S1 and S2, the abundance and distribution of suitable environments for the California spotted owl (as reflected in changes to CWHR classes) are expected to increase above current conditions by decade 2, 5, and 13 (Table 4.3.2.3k). By year 20, acres of suitable owl habitat are projected to increase by 552,051 acres in Alternative S1 and by 514,773 acres in Alternative S2 (Alternative S1 increases by 0.8% more than Alternative S2). By year 50, both alternatives show additional gains in the amount of suitable habitat but Alternative S2 is projected to result in 3.6% more acres of suitable habitat than Alternative S1.

The analytical techniques used to project tree growth and associated canopy change does not address other structural components of owl habitat. However, the standards and guidelines and desired future conditions for both Alternatives S1 and S2 (Table 4.3.2.3l) would promote structural stand diversity, which is an important component of suitable owl habitat.

Under Alternative S1, the standards and guidelines for old forest emphasis areas, including HRCAs, and forested stands of large trees with moderate to dense canopy cover would likely ensure the broad distribution of some landscapes with suitable spotted owl habitat across the range of the owl. The same outcome would be expected under Alternative S2, given the desired conditions for these land allocations.

In the HFQLG Pilot Project Area, structural stand diversity would be reduced within DFPZs using Alternative S2's HFQLG standards and guidelines.

Overall, in Alternative S1 treated areas are projected to overlap with portions of 263 PACs (20% of all PACs) while Alternative S2 would overlap with 343 PACs (26% of all PACs). This equates to 3.6% of PAC acres projected to be treated in Alternative S1 compared to 4% of PAC acres under Alternative S2. The additional acres projected to be treated are located outside the WUI and would be limited to prescribed burning. Also under Alternative S2, there is a potential for mechanically treating portions of 66 PACs in the threat zone. There is some uncertainty about the effects of this additional use of mechanical treatments with regard to California spotted owl occupancy, survival and reproduction in those PACs. The uncertainty arises from a lack of data on the effects of mechanical treatments.

Table 4.3.2l. Potential Increased Treatments Alternative S1 vs. Alternative S2.

	Mechanical Treatment**	RX Burn*	Number of Acres	# of Acres Mechanically Treated
PAC,s	66	80	1,942	5,445
HRCA			1,683	34,795
OFEA			12,667	225,421
Total			**16,292**	**265,661**

**Outside of the WUI.*
*** Mechanical treatment vs. prescribed burning.*

Relative to Alternative S1, the amount of potentially suitable habitat treated under Alternative S2 does not increase significantly (an additional 16,291 acres out of over 4 million acres in the bioregion). Structural characteristics will be affected within the 265,661 additional acres of mechanical treatments projected under Alternative S2. This alternative is also projected to treat slightly more acres within HRCAs (1,683). However, at a bioregional scale, this is only a 0.2% increase over the acres projected for treatment under Alternative S1.

The difference in change in understory stand structure between mechanical treatments and prescribed fire would vary by location and existing fuel conditions. In some cases, more stand structure effects (reduction in understory and mid-story canopy) would occur during prescribed burning with no prior fuels treatments. The effectiveness of the fuels treatment in reducing fire intensity and rates of spread through the treated areas will differ based upon treatment method and existing fuels conditions (which influences the effectiveness of the landscape fuels strategy) making definitive cumulative habitat effects determinations based upon this change in treatment type difficult.

Over the last 10 years the average amount of acres burned due to wildfire in the Sierra Nevada has increased to about 63,000 acres per year. As a result, at current rates of loss, potentially 90 additional PACs (7%) could be burned under Alternative S1 or S2. Over the last 4 years (1998 to 2002) the annual rate of loss of spotted owl PACs due to wildfire appears to have increased to 0.34 % of PACs, or an approximate average annual loss of 4.5 PACs (chapter 3). Under Alternative S1, the acreage of wildfire is projected to remain about the same as current levels. Under Alternative S2, habitat would benefit from reductions in stand-replacing wildfire 50 years into the future.

In Alternative S1, the HFQLG Pilot Project would continue to create DFPZs, group selection, and individual tree selection. Group selection would be confined to an administrative study designed by Pacific Southwest Research Station (SNFPA FEIS ROD, page 50). In Alternative S2, the DFPZs, group selection and individual tree selection would follow direction similar to that analyzed in the HFQLG FEIS. Under both alternatives, the DFPZ network would be completed in 2007 and group selection would be completed by 2009. In addition, under both alternatives, no spotted owl PACs or SOHAs would be entered with treatments for the life of the pilot project. After completion of the pilot project, management would incorporate standards and guidelines of the respective alternative.

As a result of drought, and combined with overstocked conditions, pollution, mistletoe, root disease and bark beetle infestations, Southern California forests in San Bernardino, Riverside and San Diego Counties are experiencing heavy conifer mortalities, with more than 40% mortality in some areas of the San Bernardino NF. The high level of mortality being experienced in this area is occurring within spotted owl habitat and it lies in the center of the California spotted owl population in Southern California. The San Bernardino NF began removing the hazardous fuels in 2003 and was monitoring 70 known PACs to determine effects of the drought and subsequent fuels treatments. The wildfires of October 2003 occurred within the same area. It is unknown what cumulative impact has occurred as a result of the wildfires on this subpopulation, but up to 29 territories may have been severely affected.

These risks to habitat are tempered by the adaptive management and monitoring strategy included in Alternative S2 and described in Chapter 2. A limited number of research projects and administrative studies, involving various cooperators including the Pacific Southwest Research Station, would be implemented across the bioregion. These projects would focus on key uncertainties, as well as test alternative approaches for meeting desired conditions and management objectives. Currently, a case study is in place in the HFQLG pilot project area to test the effects of vegetative treatments on spotted owl habitat and spotted owl population dynamics. An additional study will be designed to examine how owls respond to different types and extents of fuels treatments in PACs.

Population

The current condition is such that the combination of environmental and population condition provides the opportunity for the species to be broadly distributed across its historical range along the westside of the Sierra Nevada mountain range. There are gaps where populations are potentially absent or only present in low densities (AOCs). However the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and to potentially allow the species to interact as a metapopulation across the California spotted owl's historical range. Maintaining the metapopulation is keyed to the amount of habitat across the Sierra Nevada landscape and the size of the habitat gaps, created by wildfire, over the next 50 years. In this regard, Alternatives S1 and S2 cause slight changes from the current condition.

Under Alternative S2, there is some risk of negatively affecting California spotted owls in the short term because of the uncertainty associated with the effects of using mechanical treatment in PACs (potentially affects 5% of all PACs). It is assumed that because of the sensitivity of these habitat areas and the uncertainty mechanical treatments impose, line officers will proceed with extreme caution when proposing vegetation management within California spotted owl PACs and will attempt to avoid such treatments wherever possible.

4.3.2.4. Northern Goshawk

Factors Used to Assess Environmental Consequences

1. Risk relative to the distribution and abundance of northern goshawk territories in the Sierra Nevada

Measures: survey requirements, protection of known and newly discovered breeding territories, size and configuration of PACs, management of occupied PACs, management of unoccupied PACs, management of disturbance in PACs

2. Risk relative to the distribution and abundance of northern goshawk habitat throughout the Sierra Nevada

Measures: habitat elements (e.g. large trees, snags, coarse woody debris), change in nesting and foraging habitat, change in habitat suitability for prey species

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 124-142.

Risk Relative to the Distribution and Abundance of Northern Goshawk Territories in the Sierra Nevada

Survey Requirements

Both alternatives include identical standards requiring that goshawk surveys meeting established protocol be undertaken in suitable nesting habitat prior to any activity. The number of goshawk breeding territories and nest stands that become known, and are subsequently protected, would be the same under both alternatives.

Portion of Northern Goshawk Breeding Territories Protected

Both alternatives include direction to establish a 200-acre PAC around all known and newly discovered breeding territories.

Size and Configuration of PACs

Both alternatives require that PAC delineation include known and suspected nest stands and 200 acres of the best available forested habitat in the largest contiguous habitat patches, based on aerial photography. PAC boundaries are adjusted, as needed, to protect the active nest and alternate nests and to respond to habitat changes.

Management of Occupied PACs

The type and intensity of vegetation management activities that can occur within PACs differs between alternatives. The main issue concerning vegetation treatments in PACs is the trade-off between reduced susceptibility to stand replacing fires and direct effects of treatments on northern goshawk occupancy and habitat quality.

The primary difference between the alternatives is that mechanical treatment of PACs is allowed within the defense and threat zones of the wildland urban interface under Alternative S2 but only in the defense zone under Alternative S1. However, mechanical treatments would only be allowed in PACs in the threat zone where prescribed fire is not feasible and when avoiding PACs would significantly compromise the overall effectiveness of the landscape-level strategy for fire and fuels. Outside of these zones, only prescribed fire and hand clearing to reduce surface and ladder fuels is allowed within PACs. Mechanical treatments are prohibited within a 500-foot buffer around nest trees in both alternatives. When prescribed burning within PACs, hand treatments can be used to reduce the risk of damage to residual trees in one to two acres around the nest tree in Alternative S1 and anywhere in the PAC in Alternative S2. In Alternative S2, the standard for vegetation treatments within a PAC located in a threat zone requires that mechanical treatments be designed to “maintain habitat structure and function of the PAC.”

Approximately 590 northern goshawk breeding territories are known to exist on the Sierra Nevada national forests (FEIS chapter 3, part 4.4, page 114). PACs have been established for a portion of these territories, encompassing 93,850 acres, but the mapping is incomplete. Forests will be updating and refining this information as they enter goshawk sighting data and goshawk PACs into the new Forest Service geographic information system which will allow for better regional accounting for numbers and acres of goshawk PACs in the future. For this analysis, PAC acreage in each land allocation and the total number of breeding territories known were used to estimate the number of PACs in each land allocation (table 4.3.2.4a).

Table 4.3.2.4a. Goshawk PACs by Land Allocation.

	Urban Core	Defense Zone	Threat Zone	General Forest and Old Forest Emphasis Area	Totals
Acreage	345	4,395	22,765	66,345	**93,850**
Percent of total PACs	0.3%	4.7%	24%	71%	**100%**
Extrapolated number of breeding territories	1	28	142	419	**590**

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Under Alternative S1, vegetation treatments would be allowed in up to 5% of PACs per year and 10% per decade unless a formal monitoring and adaptive management approach is developed. Alternative S1 would limit treatment to no more than portions of 118 PACs over the 20 years of planned treatments (20% for the two decades). Assuming that most of the 128 goshawk PACs in the defense zone will require treatment, only portions of 90 additional PACs could be affected by prescribed burning. Since prescribed burn units use physical features such as roads and terrain features such as ridges and streams to define their boundaries, it is likely that portions of goshawk PACs would occur within logical treatment boundaries but would have to be excluded if the threshold number of PACs was exceeded.

Alternative S2 recognizes that in order for the fuels treatment strategy to be effective, a strategic pattern of area treatments must be completed and fuels within treatment units must be effectively treated. Alternative S2 provides direction to avoid including PACs within planned treatment units to the extent possible, and allows vegetation treatments in up to 5% of total PAC acres per year and 10% of total PAC acres per decade. Alternative S2 recognizes that in many cases, only portions of goshawk PACs would be proposed to be affected and balances this effect against potential long-term habitat gains by more effectively reducing future wildlife size and intensity. As for the California spotted owl, which uses a similar approach for PACs, under Alternative S2 portions of more goshawk PACs might be treated than under Alternative S1, but the total acreage of PACs treated is not expected to be substantially higher. This is primarily due to the strong direction to avoid PACs to the extent possible in Alternative S2. It is expected that effects to PACs would be tracked through implementation monitoring to evaluate the assumption that projects are minimizing impacts to PACs.

Given historical fire patterns in the Sierra Nevada, a reasonable hypothesis is that light underburns similar to those that occurred prior to the late 1800s would not result in territory abandonment, provided that high levels of canopy cover and high densities of large trees in nest stands were not affected. Treatments that mimic these conditions, such as prescribed burning, would be expected to affect northern goshawks less than mechanical thinning, which might remove small and medium-sized trees and lower the canopy cover. Conditions immediately surrounding the nest (within a 500 foot buffer) would likely be minimally changed in either alternative, because mechanical treatments are prohibited. It is likely that treatments within PACs would affect goshawk prey species immediately following treatment. The extent and duration of these effects and the difference between different types of treatment (prescribed burning versus mechanical treatments of various intensities) on goshawk prey are not well know. Treatments within PACs could affect territory occupancy in subsequent years. No empirical data are available to address the effects of various fuels treatments on northern goshawk occupancy, survival, and reproduction in PACs.

Management of Unoccupied PACs

Management of unoccupied PACs would be the same under both alternatives: all PACs are maintained regardless of the status of goshawk occupancy, unless habitat is rendered unsuitable by a catastrophic stand-replacing event and protocol surveys confirm non-occupancy.

Management of Disturbance in PACs

Goshawks are thought to be sensitive to human disturbance during the nesting season. Alternatives S1 and S2 require that a survey be conducted to establish or confirm the location of the nest when activities are planned within or adjacent to a PAC. Both alternatives would invoke a LOP, prohibiting vegetation treatment within approximately ¼ mile of the nest site during the breeding season (February 15 through September 15), unless a survey confirms that northern goshawks are not nesting. The LOP may be waived for vegetation treatment of limited scope and duration, if a biological evaluation results in a finding that the project is unlikely to result in breeding disturbance, considering project intensity, duration, timing, and specific location. LOPs could also be waived in up to 5% of PACs per year, to allow early-season prescribed burning. Under Alternative S1, activities other than vegetation treatments would also be restricted using an LOP during the breeding season. Alternative S2 does not require an LOP for other than fuels and vegetation management projects, instead relying on existing Forest Service policy for biological evaluations to evaluate if an LOP is necessary to protect nest sites from disturbance.

Risk Relative to the Overall Distribution and Abundance of Northern Goshawk Habitat throughout the Sierra Nevada

Large trees

Alternatives S1 and S2 are expected to result in general increases in mature and late-seral forests and numbers of large trees (≥ 30” dbh) and very large trees (≥ 50” dbh). Within treated areas, both alternatives protect all trees ≥ 30” dbh. In these areas, large trees will be indirectly affected through incidental damage from project operations and prescribed burning, but the risks of large tree mortality from insects and disease and high intensity wildfires will be reduced. In untreated areas, large trees may remain at higher risk of mortality where stands are at a denser stocking than historic levels. Large trees in these dense stands may be at risk from damage or mortality from insects and disease, particularly during prolonged drought and may be at risk of damage from high intensity wildfire.

Snags

Across the bioregion, the number of snags >15”dbh is projected to increase gradually for approximately 100 years, and then remain relatively constant under Alternatives S1 and S2. Outcomes will likely be similar, but there may be more opportunity to retain clumps of snags in Alternative S2 than in Alternative S1. Alternative S2 also specifically includes direction to consider snag recruitment and retention of decadent live trees that are likely to serve as nest sites for goshawks. The number of snags would be adequate to meet desired conditions under Alternatives S1 and S2.

Coarse Woody Debris

Standards for down woody debris would be essentially the same under Alternatives S1 and S2.

Change in Nesting and Foraging Habitat

Across the bioregion, highly suitable nesting and foraging habitat for goshawk (CWHR classes 5D, 5M) is projected to slightly to moderately increase over time, with greater short-term increases under Alternative S1 and greater long-term increases under Alternative S2. Generally, the trend towards more late-seral habitat is attributed to the transition of CWHR classes 4D, 4M, and 6 into classes 5D and 5M through growth (FEIS volume 3, chapter 3, part 4.4, page 130). The mix of CWHR classes would change similarly under both alternatives, with a reduction in classes 4D and 4M and a commensurate increase in classes 5D and 5M.

Foraging habitat preferences of northern goshawks are poorly understood, although limited information from studies in conifer forests indicate that northern goshawks seem to prefer to forage in mature forests (summarized in Squires and Reynolds 1997). Hargis et al. (1994) reported that telemetry points within home ranges of northern goshawks had greater basal area, canopy cover, and tree diameters compared to random plots in eastside pine vegetation in eastern California.

In the eastside pine type, under Alternative S2 nesting and foraging habitat conditions may not be maintained on the treated acres. Alternative S2 allows removal of up to 70% of the basal area within a treatment unit with no lower limit for canopy cover retention. This could render habitat unsuitable for nesting or foraging. However, treatments in Alternative S2 are limited to only 25% of the landscape in a strategic pattern. This should act to limit the effects to nesting and foraging habitat within a watershed. The effects on nesting and foraging habitat would be considered site-specifically in project biological evaluations under both alternatives, and mitigations to retain higher levels of stand basal area or canopy cover to ensure adequate foraging and nesting habitat within a project area could be incorporated into individual projects.

When comparing effects of the alternatives on goshawks, protection of habitat from wildfire is an important consideration. Under Alternative S1, projected wildfire acreage per year is expected to remain constant compared to current rates. Under Alternative S2, the average annual acreage of wildfire is projected to decrease from the current rates. Acreages projected to experience lethal or stand-replacing wildfires under both alternatives are proportional to the trend. The extent that past wildfires have affected goshawks can not be fully evaluated since many areas previous burned had not been previously surveyed.

Change in Habitat Suitability for Prey Species

Projected changes in overall habitat utility for prey species important to northern goshawk were estimated using CWHR habitat utility ratings and vegetation projections (table 4.3.2.4b). For Alternative S1 and S2, habitat utility ratings for almost all prey species are projected to remain similar to current conditions in the short tem (20 years). In the long term (140 years), habitat utility for the majority of prey species is projected to increase under both alternatives. Very little difference exists between the alternatives at the two time frames. This suggests that Alternatives S1 and S2 are likely to provide for goshawk prey species in the short-term and long-term across the bioregion.

Table 4.3.2.4b. Projected Changes in CWHR Habitat Utility for Prey Important to Northern Goshawk for Alternatives S1 and S2.

Species ID	Species Name	Habitat Utility in 2004 (ac)	S1 Habitat Utility in 2024 (ac)	S2 Habitat Utility in 2024 (ac)	S1 Habitat Utility in 2144 (ac)	S2 Habitat Utility in 2144 (ac)	Comparison S2/S1 in 2024 (%)	Comparison S2/S1 in 2144 (%)
B308	Pileated woodpecker	1,798,571	1,953,456	1,892,494	2,528,500	1,898,205	96.9	75
M079	Douglas squirrel	2,683,991	2,798,936	2,859,770	3,342,573	3,525,841	102.2	105.5
B134	Blue grouse	3,660,139	3,782,755	3,738,346	4,573,016	4,460,759	98.8	97.5
B386	Hermit thrush	291,913	323,311	307,327	378,763	373,399	95	98.6
B306	Black-backed woodpecker	665,731	653,868	659,354	643,908	627,783	99.9	97.5
B350	Clark's nutcracker	1,198,238	1,207,143	1,209,372	1,240,569	1,250,652	100.2	100.1
B346	Stellar's jay	4,094,797	3,952,366	4,020,916	4,551,701	4,543,667	101.7	99.8
B307	Northern flicker	3,460,407	3,290,264	3,356,755	3,963,451	3,983,195	102.0	100.5
B251	Band-tailed pigeon	2,423,461	2,307,402	2,365,897	2,812,093	2,876,432	102.5	102.3
B141	Mountain quail	4,024,498	3,777,261	3,839,262	4,334,943	4,214,568	101.6	97.2
B471	Western tanager	3,798,761	3,614,739	3,694,580	4,079,832	4,154,226	102.2	101.8
B299	Red-breasted sapsucker	3,503,232	3,338,130	3,409,324	3,837,977	3,810,780	102.1	99.3

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Within treatment units, there may be slight differences between the alternatives. The potential for a slightly higher reduction in canopy cover in Alternative S2 could affect some of the prey species, at least in the short-term. Since treatments occur in a distributed pattern across landscapes, the proximity of treatment units to goshawk territories would be important to consider in assessing potential impacts to prey species. Under any alternative, treatments would likely only affect a portion of the foraging habitat within a given territory.

Cumulative Effects

Habitat

Suitable habitats for goshawk are currently either broadly distributed or highly abundant across the range of the species. However, temporary gaps exist where suitable environments are absent or only present in low abundance. Disjunct areas of suitable environments are typically large enough and close enough to permit dispersal and interaction among subpopulations across the range of the species. Alternative S1 would result in some habitat improvement because stand complexity would be maintained over time and conditions for prey species would improve. Alternative S2 would result in conditions nearly the same as current conditions.

Under Alternative S1, standards and guidelines for old forest emphasis areas and stands of large trees with moderate to dense canopy cover would provide for broad distribution of some landscapes with suitable foraging habitat for goshawk on both the east and west side of the Sierra Nevada. Alternative S2 could affect suitable habitat in eastside pine to a higher level than Alternative S1, but the effects to goshawks are likely to be moderated through site-specific project evaluation. Alternative S2 provides for potential increases in suitable habitat across the bioregion. Management for California spotted owl and fisher would likely ensure that mid- and late-seral stage habitat would be broadly distributed in westside Sierra Nevada forests and in eastside forests where owls currently occur. This management would benefit goshawk as well.

Population

Current habitat and population conditions provides opportunities for goshawk to be broadly distributed and highly abundant across its historical range; however gaps exist where populations are potentially absent or only present in low density. The disjunct areas of higher potential population density, however, are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range. Required surveys of suitable habitat and the use of limited operating periods to protect nest attempts from disturbance in both alternatives increase the likelihood of protection for breeding territories over time. Alternatives S1 and S2 would result in similar and only slight changes from the current condition.

4.3.3.5. Willow Flycatcher

Factors Used to Assess Environmental Consequences

The definition of willow flycatcher site occupancy would change under Alternative S2. Definition of occupancy is therefore treated as a separate evaluation factor for evaluating the alternatives.

1. Protection of sites occupied by willow flycatchers
Measure: definition of sites managed for protection of willow flycatchers

2. Livestock grazing
Measure: grazing season of use, duration, methods, and utilization

3. Monitoring breeding success and habitat conditions
Measure: survey requirements, habitat monitoring

4. Habitat restoration of degraded areas for population expansion
Measure: direction to restore degraded areas to desired conditions

5. Brown-headed cowbird brood parasitism
Measure: activities that reduce brown-headed cowbird influence

Analysis Assumptions and Limitations

All of the standard and guidelines related to meadow utilization, willow browse utilization, streambank trampling, and cowbird parasitism from the FEIS ROD apply to both Alternative S1 and S2. Livestock grazing is guided by an allotment management plan, a grazing permit, and an annual operating plan for each permittee. Adjustments to annual operations are made if substantial new information on species occurrence becomes available, or if mitigation measures to avoid habitat such as fencing or herding are found to be ineffective. These changes can occur in two time frames: immediately and/or during operations in the following year.

Willow flycatchers may benefit from management for other species, such as the mountain-yellow legged frog and the Yosemite toad, to the extent that livestock management requirements result in improvements in willow habitats or decreases in the risk of brown-headed cowbird population expansion. The extent of this benefit is unknown as the amount of species overlap is not fully known.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 166-195.

Protection of Sites Occupied by Willow Flycatchers

Under Alternative S1, *known willow flycatcher sites* are defined to be all sites at which reasonably valid recorded sightings were made of the species during the breeding season, including records from as far back as 1910. As discussed in chapter 3, since preparation of the FEIS, the number of *known sites* has been reduced to 74. For Alternative S2, the definition is refined into two primary categories: *occupied* and *historically occupied* (Robinson and Stefani 2003) and one interim category: *conditionally occupied*. Under Alternative S2, *occupied sites* require that observations of site occupancy have occurred since 1982. This definitional change under Alternative S2 affects nine of the 74 known sites: four sites for which no observations have been made since 1982, three sites where the month and day of observation were not recorded, and two sites where the detection date was after August 15 (table 4.2.3.5a).

Table 4.2.3.5a. Status of 9 of the 74 known willow flycatcher sites identified in the FEIS.

Site	National Forest	Last Occupied	Last Surveyed	Status	Alternative S2 Classification
Parker Lake	Inyo	1936	1986	No records after 1982, meadow less than 1 acre	Historically Occupied
Cottonwood Creek	Inyo	1954	2002	No records after 1982	Historically Occupied
Mammoth Creek	Inyo	1973	1973	No records after 1982, meadow less than 1 acre	Historically Occupied
Hull's Meadow	Stanislaus	1939	2002	No records after 1982, may be on private land	Historically Occupied
Blue Lake Ranch Meadow	Modoc	1984	1997	Month and day not recorded	Conditionally Occupied
Bohler Canyon	Inyo	1994	2002	Month and day not recorded	Conditionally Occupied
Westwood Junction	Lassen	1999	1999	Month and day not recorded	Conditionally Occupied
Willow Campground	Inyo	1984	1997	Detection after August 15	Conditionally Occupied
Long Valley Creek	Stanislaus	1982	2002	Detection after August 15	Conditionally Occupied

(Source: USDA Forest Service, Pacific Southwest Region 2003c)

Under Alternative S2, the four sites occupied prior to 1982 are considered to be *historically occupied*. Since livestock use at these sites would not automatically be restricted to late season grazing, any undetected nests and occupancy could be disturbed by livestock. The current willow flycatcher survey protocol for California (Bombay et al. 2000) assumes a 70-90% certainty of detecting at least one willow flycatcher if any exist at the site. For historically-occupied sites currently being grazed by livestock (one site), direction in Alternative S2 requires that appropriate actions be taken (which can include adjusting grazing activity) to modify current meadow conditions toward desired conditions. Additional standards and guidelines set browse standards to less than 20% for willows, requiring livestock to be removed when they switch to browsing on willows. In addition, these sites would be included in the systematic survey cycle, so that future occupancy of the sites would likely be detected in a reasonable timeframe. If detections were made that met protocol, this site would be classified and managed as an *occupied site*.

Under Alternative S2, a temporary category of *conditionally occupied* sites would be established and include the three sites where the month and day of detection are unknown and the two sites where detection occurred after August 15. These sites would be retained and managed as *historically occupied* sites until one survey cycle was completed. If no willow flycatcher detections were made during this survey cycle, they would be removed from the list of willow flycatcher sites. Little difference in effects between the alternatives would be expected as a result of this classification. Since these sites are based on fairly recent detections, habitat conditions are not expected to have changed sufficiently to preclude willow flycatcher occupancy. Additional surveys will increase the likelihood of determining whether these sightings represented reproductive territories or were incidental sightings. If surveys do not detect willow flycatchers and the site is dropped from the list, it would not be automatically surveyed in the future. This poses a slight risk that an occupied territory would remain undetected. This could result in nest disturbance at the four sites in active livestock allotments because restrictions on livestock grazing season would not be applied. As noted above, the current survey protocol provides a 70-90% certainty of detecting individuals if they are present.

Under Alternative S2, there would be no special emphasis on developing restoration objectives for sites dropped from the occupied or historically occupied list, and actions to specifically restore willow flycatcher habitat would less likely be taken. However, sites with impaired hydrologic function would receive emphasis regardless of willow flycatcher occupancy.

No direction would preclude survey of any of these sites, if managers determined that additional surveys were needed for local decision-making, and nothing would preclude managers from developing and implementing restoration projects for individual meadows. Decisions to survey or develop restoration projects for any sites that may be dropped as a result of this process would be based upon the site-specific conditions.

Table 4.2.3.5b summarizes the site classification for willow flycatchers that occur primarily on national forest land under Alternatives S1 and S2.

Table 4.2.3.5b. Site Classification for Willow Flycatchers Alternative S1 and S2.

Alternative	Known (S1) Occupied (S2) 1982	Historically Occupied (S2 only)	Conditionally Occupied (S2 only)	Total Sites
S1	74	n/a	n/a	**74**
S2	65	4	5	**74**

(Source: USDA Forest Service, Pacific Southwest Region 2003c)

An additional eight sites occur on private land but within allotment boundaries; seven within active cattle allotments and one within an inactive allotment. An additional nine sites occur on private lands outside of allotment boundaries but are associated with meadows that appear to span onto national forest lands. Of these sites, a visual inspection of the geographic information system data suggests that four sites are in close proximity (less than 0.5 miles) to active allotments. These sites do not currently have special status under either alternative. They would be evaluated locally during allotment planning to determine if they are affected by livestock grazing.

Livestock Grazing

Under Alternative S1, grazing would be restricted to the late-season (after August 30) in meadows where willow flycatchers were at one time documented during the breeding season, even though recent surveys may indicate that the sites are not currently occupied. This standard is based on the potential for site occupancy in future years. When a site is occupied, this alternative would require that the grazing of the entire meadow be deferred until after August 30, to ensure protection of the hydrologic function of the meadow, reduce the potential for brown-headed cowbird parasitism, and eliminate the potential for incidental and unintended intrusion by livestock into the vicinity of the nest site.

Under Alternative S2, at *occupied sites*, managers would have the option to either

- restrict grazing to late-season (after August 15) in the entire meadow, or
- develop a management strategy that ensures that habitat is protected during the breeding season and that long-term habitat suitability is maintained.

Data from the a demographic study of willow flycatcher populations in the Sierra Nevada indicate that approximately 10% of nesting attempts have occurred after August 15. Some of these late nesting attempts appear to have been influenced by weather patterns, when late spring storms have delayed nesting. In extreme years where willow flycatcher nesting is delayed due to wet weather, the initial "on date" when livestock are allowed onto the allotment would likely also be delayed, moderating the risk of potential nest disturbance. Standards and guidelines for management of willow utilization, and direction to remove livestock once they switch to browsing on willows, should also minimize this risk and result in little difference between alternatives. Some studies have suggested that late-fledging willow flycatchers may have a lower survival rate than earlier fledging individuals (Sedgwick and Iko 1999) but this effect in Sierra Nevada populations and the effects of late season grazing on survival rates is unknown. The importance of these late-fledging individuals to overall population stability is currently not known.

The number of site-specific management strategies that would be developed under Alternative S2 to allow deviation from the post-August 15 grazing season date is not known. All sites would likely not be included in this approach, because some livestock permittees have indicated that the presence of willow flycatchers within their allotment is not likely to cause a significant change in allotment use. Others have noted that alternative livestock management strategies would likely involve more intensive livestock management techniques, which may increase management costs for the affected permittees. Use of herding or fencing would not be economically feasible to implement in many cases. Because site-specific management strategies would focus on protecting habitat during the breeding season and on the long-term sustainability of suitable habitat at breeding sites, the difference in effects between the alternatives are expected to be minor.

To address some of the uncertainty about the effects of grazing on willow flycatchers under either alternative, sites subject to late-season grazing would be monitored to assess annual forage utilization and willow flycatcher habitat condition. Monitoring data would be included in a GIS meadow coverage. The Forest Service's *Rangeland Analysis and Planning Guide* (R5-EM-TP-004) describes annual utilization monitoring. See Appendix U of the FEIS for a description of monitoring techniques for willow flycatcher habitat condition. If habitat conditions are not supporting willow flycatcher use or are trending downwards, grazing will be suspended or modified.

Monitoring Breeding Success and Habitat Conditions

Under both alternatives, the Regional Forester will continue to direct study of the demographics of the willow flycatcher in the Sierra Nevada and conduct systematic, cyclic surveys of known sites.

Under Alternative S1, willow flycatcher emphasis habitats (i.e. suitable habitat within 5 miles of known willow flycatcher sites) would be surveyed consistent with established protocol every three years, to determine if willow flycatcher populations are expanding into these areas. If surveys are not conducted in particular emphasis habitats within 3 years, only late season (after August 30) livestock grazing would be allowed. Alternative S2 would allow line officers to determine priorities for surveying emphasis habitat. Alternative S2, however, requires that surveys of emphasis habitats be conducted consistent with established protocol as part of project planning (i.e. if a project is proposed that could potentially affect emphasis habitat, surveys would be conducted prior to project approval). This allows line officers the choice to defer the cost of surveying emphasis habitat in inactive allotments or outside of allotments when budgets are limited. If surveys are not conducted in some emphasis habitat, there is the potential that new territories could go undetected. Since the primary intent of late season grazing requirements is to protect nests from physical disturbance, there is little additional risk because these areas would not be in active allotments.

Neither alternative includes direction for surveying emphasis habitat surrounding sites other than the 74 known sites (Alternative S1) or occupied and historically occupied sites (Alternative S2). Without surveys, some sites may become occupied but go undetected. Livestock grazing impacts on these sites will be evaluated as part of the biological evaluation completed during allotment planning.

Habitat Restoration of Degraded Areas for Population Expansion

Under Alternative S1, meadow restoration opportunities near willow flycatcher sites would be prioritized. Alternative S2 would require suitability assessment of willow flycatcher habitat whenever an occupied site is determined to be unoccupied. If the habitat at the site is determined to be degraded, restoration objectives would be developed and appropriate actions would be implemented to change meadow conditions toward desired conditions, such as physical restoration of hydrological components and limiting or re-directing grazing activity. Efforts to focus habitat restoration for population expansion at the bioregional scale will provide benefits to the population.

Risks from brown-headed cowbird brood parasitism

There are no direct changes in management between Alternatives S1 and S2 specifically regarding cowbird management. Alternative S2 allows late season grazing to occur two-weeks earlier in occupied willow flycatcher habitat than Alternative S1. This could indirectly result in increased risk of attracting brown-headed cowbirds, however, it would be late in the willow flycatcher breeding season, reducing the risk of within season effect to willow flycatcher nest success. Although approximately 10% of willow flycatcher nests are estimated to still be active after August 15, the egg and incubation stage is generally over by this date making nests less susceptible to successful parasitism. It is unknown how attracting cowbirds at this time of year would affect overall cowbird distribution in future years since cowbirds tend to occupy sites of low herbaceous vegetation or active grazing and these sites would not be grazed during the primary brown-headed cowbird breeding season. Alternative S2 allows deviation from the late-season grazing requirement if a site-specific management strategy is developed. Earlier grazing could attract cowbirds during their breeding season which could increase the risk of nest parasitism. A requirement of the management strategy is that it must protect willow flycatcher habitat and provide for long-term habitat suitability.

The willow flycatcher conservation assessment determined that brood parasitism does occur in the Sierra Nevada but does not appear to be a significant problem at this time. Nevertheless, localized rates of parasitism could be a problem for some sites and reducing overall cowbird populations would lessen the risk of effects to individual nesting individuals. The effects of any site-specific management would need to consider the effects on brown-headed cowbird parasitism. The conservation strategy that will be developed for this species should help to evaluate and prioritize the concern for brown-headed cowbird brood parasitism and will be used to inform local management decisions.

HFQLG Pilot Project

Under both alternatives, actions in the HFQLG Pilot Project Area will be consistent with the SAT guidelines during the life of the Pilot Project; thereafter direction from the AMS will apply. The effects of implementing the SAT guidelines have been analyzed and discussed in the HFQLG FEIS and biological evaluation, and the effects of implementing the SAT guidelines in lieu of the AMS have been evaluated and discussed in the SNFPA FEIS and biological evaluation. The SAT guidelines provide similar protection of riparian vegetation and condition as provided under the AMS and would likely result in similar effects on riparian areas where this species may occur. Moreover, both alternatives include the same management direction for willow flycatchers within the pilot project area.

As part of the S2 Adaptive Management Program (see Chapter 2, Description of Alternative S2), initiation of a Willow Flycatcher Conservation Strategy is recommended. This will evaluate and prioritize opportunities for site protection and habitat management and restoration across the bioregion based upon current populations and habitat conditions and considering risk and threats on a population basis. Also, as part of the S2 Adaptive Management Program, the continuation of the Meadow Status and Change Monitoring Study Plan is recommended. This will identify needs and opportunities for meadow management to improve habitat conditions that will benefit willow flycatchers. Both of these efforts will reduce the uncertainty about effects of management and increase our understanding of complex meadow ecosystems.

Adaptive Management Program

Cumulative Effects

Habitat

Under Alternatives S1 and S2, suitable but isolated environments for willow flycatcher would persist in low abundance on the national forests. Although some of the subpopulations associated with these environments may be self-sustaining, opportunities for interactions among populations in many of these suitable environmental patches are limited. Both alternatives provide specific direction for management of RCAs and meadow ecosystems, which should assure continued contribution of these patches to potential habitat.

Habitat for this species consists of montane meadows that support willows and remain wet through at least midsummer. Montane meadows in the Sierra Nevada that meet these criteria are limited in extent and are not evenly distributed across the 11 national forests. Past and recent land management, primarily grazing, has likely reduced habitat capability of otherwise suitable meadows by reducing or eliminating the willow and woody shrub component and changing meadow hydrology. Less intensive grazing from increasing numbers of inactive allotments, reductions in livestock numbers, and adjustments in livestock management to address resource concerns, has allowed willows to begin recovering in some areas. This should increase habitat over time. Current direction in both alternatives that limits willow browsing will also aid in willow maintenance and restoration.

Conifer encroachment in meadows and climate related drying of meadows are not directly addressed in the alternatives but may continue to degrade willow flycatcher habitat. The role of fire in mountain meadow ecosystems is not well understood and fire suppression and the alteration of fire disturbance patterns may also be contributing to cumulative habitat reductions.

The AMS should help to improve degraded meadow conditions. Standards and guidelines to protect aquatic resources, excluding those related to livestock grazing aspects, would be the same under either Alternative S1 or S2 and emphasis would be placed upon identifying opportunities for meadow restoration.

Population

Habitat and population conditions currently restrict the potential distribution of this species, which is highly isolated. Potential abundance is very low. Gaps, where the likelihood of population occurrence is low, are large enough that little or no possibility of interaction, strong potential for extirpations, and little likelihood of recolonization prevail.

Willow flycatcher populations are naturally disjunct, as a direct result of the scattered availability of suitable meadow habitats. Given the dispersal ability of the species, it is not likely that populations are completely isolated, even if disjunct. Alternatives S1 and S2 would be expected to slightly improve population status, because surveys of sites known to be occupied and emphasis habitats adjacent to these sites would be surveyed, which would increase the potential for identifying and protecting new territories. Alternatives S1 and S2 are expected to support continued breeding at known sites and to allow development of suitable habitat at other sites to allow the opportunity for population expansion.

4.3.2.6. Great Gray Owl

Factors Used to Assess Environmental Consequences

The risk factors identified for the great gray owl in chapter 3 of this document focus upon two primary areas: nesting habitat and prey species. Survey requirements and requirements to protect known and newly discovered breeding territories are the same for both alternatives. This assessment also addresses the following factors:

1. Maintaining existing suitable nesting habitat in occupied territories and improving the quality of suitable habitat where occupancy is unknown
Measures: Management activities within PACs, risk of loss to wildfire

2. Maintaining and improving habitat for voles (*Microtus* spp.) and pocket gophers (*Thomomys* spp.) adjacent to PACs
Measure: Management practices, including aquatic and meadow management practices

Analysis Assumptions and Limitations

The FEIS ROD requires that surveys meeting established protocol be conducted only in response to reliable sightings of great gray owls (page A-38). However, requirements of Forest Service Manual Chapter 2670 for biological evaluations would be considered during project planning, which may lead to additional surveys where occupancy is suspected. These requirements would apply to Alternatives S1 and S2. In addition, a survey protocol for great gray owls applicable to both alternatives has been developed to improve consistency and reliability of surveys.

Under both alternatives, PACs would be delineated by including at least 50 acres of the highest quality nesting habitat available in the forested area surrounding nests and the meadow or meadow complex that support a prey base for the nesting owls. PACs are established when new nesting sites are located. To date, few great gray owl PACs have been delineated. Additional breeding territories may be discovered and PACs may be added in the future.

Existing direction is not specific regarding establishing PACs and managing meadows where great gray owl nests occur on adjacent private land. However, managers consider habitat use on adjacent public lands in determining the need to establish a PAC or in applying livestock grazing standards and guidelines to meadows.

No specific direction is provided to preferentially avoid vegetation treatments in great gray owl PACs. Because few great gray owl nest sites occur on national forest lands, treatments within PACs under either alternative may be designed to retain preferential habitat features (i.e. large snags, large diameter trees, high canopy cover) within PACs to avoid adverse effects to the species.

Prey habitat relationships in regard to the height of herbaceous vegetation are largely unknown for the Sierra Nevada. Primary prey species appear to be voles and pocket gophers. These two species likely have different preferences for the height of herbaceous vegetation; however, the relationship between herbaceous height, species abundance, and vulnerability to predation by great gray owls is not well understood for either species. They also tend to utilize slightly different areas of meadows, with pocket gophers preferring the drier portions of meadows while voles tend to prefer moister portions, resulting in a complex abundance and distribution between the species that is unique to each meadow. There are also several gopher and vole species that occur throughout the Sierra Nevada and the habitat preferences by species may vary.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.2, pages 29-39.

Maintaining Existing Suitable Nesting Habitat in Occupied Territories and Improving the Quality of Suitable Habitat Where Occupancy Is Unknown

Management Activities within PACs

Under Alternative S1, management of PACs is primarily accomplished by evaluating nest site disturbance from roads, trails, off highway vehicle routes, recreation, and other developments. LOPs would be required for activities around nest sites to minimize the risk of disturbance during the nesting season. Under Alternative S2, LOPs would apply to fuels and vegetation treatments only. LOPs for other activities would be evaluated during project design and in biological evaluations to reflect site-specific conditions. Where appropriate, they would be incorporated into non-fuels and vegetation project decisions.

Neither alternative defines or requires management of specific great gray owl habitat components within PACs or limits the amount and intensity of vegetation treatments allowed within them. Grazing standards would be imposed, as discussed below.

The opportunity to salvage dead and dying trees in response to drought, insect and disease outbreaks, and wildfire—trees that might otherwise be used for nesting—differs between the alternatives. In general, Alternative S1 involves more limitations on the removal of dead trees and would require retention of most dead trees in the old forest emphasis areas. Under Alternative S2, site-specific evaluation and local decision-making would be allowed to remove dead and dying trees for a variety of purposes within treated areas. To maintain nesting potential for the species, a continual supply of large diameter snags in PACs and adjacent areas is important. No specific direction for snag retention specific to great gray owls is included in either alternative; however, when planning projects in owl habitat, the need to provide snags as nesting substrates should be considered with the need to reduce fuel levels and risks of future wildfire losses. Because great gray owl nest sites are located adjacent to montane meadows, typically at mid- to high-elevations and away from human activity (most are outside of the WUI), and because great gray owl PACs are relatively small in size, it is expected that most PACs can be avoided during fuels treatments under both alternatives. As a part of project planning, existing nest snags and replacement nest snags will be identified within and immediately adjacent to PACs, to provide sustained nesting opportunities.

Risk of Loss to Wildfire

Both alternatives reduce the acreage and intensity of wildfires. This could have a direct beneficial bearing on great gray owls if losses of habitat are reduced. Under both alternatives, treatments would initially be focused in and around the WUI, resulting in relatively less benefit to great gray owls because the species primarily occurs outside of the WUI. Under Alternative S2, treatments would be more effective in terms of reducing the acreage burned each year and the fire intensity. This would reduce losses of habitat to wildfire. Within the acres burned, it is unknown how many territories or how much great gray owl habitat may have been affected by wildfire within the last decade.

Maintaining and Improving Habitat for Voles (*Microtus* spp.) and Pocket Gophers (*Thomomys* spp.) Adjacent to PACs

Alternative S1 includes a provision to maintain herbaceous meadow vegetation ≥12" in height over at least 90% of meadows in great gray owl PACs. Standards and guidelines applicable to all meadows address streambank trampling and utilization of vegetation by livestock. Where other managed wildlife species occur (i.e. willow flycatcher and various amphibians), additional standards and guidelines may apply. These standards and guidelines serve to limit adverse impacts from livestock grazing on meadows and riparian vegetation.

Under Alternative S2, the 12" herbaceous height requirement for meadows associated with great gray owl PACs would be replaced with a requirement to maintain herbaceous vegetation at a height commensurate with site capability and habitat needs of prey species. This height would be set site-specifically. This change acknowledges the variability in both individual meadow productivity and in great gray owl prey composition (the proportion of voles and pocket gophers in the diet). Because the latest scientific information is continually used in assessing habitat relationships of voles and pocket gophers, this alternative should provide increased management flexibility while providing adequate measures to provide for great gray owl prey within PACs. The standards and guidelines described for Alternative S1 related to streambank trampling and utilization also apply to Alternative S2.

The control of gophers for protection of plantations is not directly addressed in either alternative. The need for this control would continue to be locally evaluated and determined. Gopher control has been carried out on forests with great gray owls (e.g. Stanislaus National Forest), and management practices have been developed and implemented to reduce the risk of adverse effects to them. These local practices would continue to be applied, where appropriate, under either alternative.

HFQLG Pilot Project

By law, actions in the HFQLG Pilot Project Area will conform to the SAT guidelines during the life of the project and the AMS thereafter. The effects of implementing the SAT guidelines are discussed in the HFQLG FEIS and biological evaluation, and the effects of implementing the SAT guidelines in lieu of the AMS are discussed in the SNFPA FEIS and biological evaluation. The SAT guidelines provide protection of riparian vegetation and condition that is similar to that under the AMS and are projected to result in similar effects on riparian areas where this species may occur. Moreover, Alternatives S1 and S2 include the same management direction for great gray owls within the pilot project area.

Cumulative Effects

Habitat

Currently, suitable habitats for great gray owls are mostly isolated and exist in very low abundance on the national forests. While some of the subpopulations associated with these habitats may be self-sustaining, opportunities for interactions among populations in many of these suitable habitat patches are limited. Both alternatives would result in improved habitat condition.

Habitat for this species consists of mature forest adjacent to large montane meadows that support high prey populations. Montane meadows in the Sierra Nevada that meet this criteria are limited in extent and are not evenly distributed across the 11 national forests. Past and recent land management has likely reduced habitat capability of otherwise suitable meadows by reducing residual herbaceous height below heights required by prey species, changing meadow hydrology, reducing large snags and green trees around large meadows, and allowing increases in recreational activity.

Historic land use (ranching and homesteading) and livestock grazing practices have altered meadow hydrology in some areas, irreversibly in some instances. In most areas, the current reduction in livestock grazing that has occurred over the last two decades has resulted in improved conditions in meadows. Conifer encroachment in meadows may be incrementally reducing habitat as a result of fire suppression and modern climate conditions.

Alternative S1 includes provisions for maintenance of residual herbaceous plant material in meadows used by great gray owls, to support key prey species. It also requires a review of potential human disturbance from vegetation management, roads, trails, and recreation. Application of the alternative's standards and guidelines and the AMS should help to improve degraded meadow conditions. Large trees and large snags would be retained in treatment areas, and treatment areas would be more restricted than under Alternative S2. The risk of loss of habitat from wildfire would be reduced relative to current trends.

Alternative S2 includes provisions for the maintenance of residual herbaceous plant material as does Alternative S1; however, the exact height to be maintained is based on local ecological conditions. Potential human disturbance from roads, trails, and recreation would be reviewed as in Alternative S1, but the application of LOPs would be locally determined for those activities. LOPs for vegetation management projects would be the same as Alternative S1. Standards and guidelines to protect aquatic resources, including meadow ecosystems, would be the same as under Alternative S1. Alternative S2 would pose a greater potential that some large trees and snags could be removed, compared to Alternative S1. However, removal of these features is not required and would be assessed at the project-level. Alternative S2 is projected to result in a greater reduction in annual burned acreage and acres burned by high intensity wildfire compared to Alternative S1, thus reducing the risk of loss of habitat. In both alternatives, treatments outside the WUI would result in greater indirect benefits to great gray owl habitat by reducing wildfire risk.

Population

Habitat and population conditions currently restrict the potential distribution of this species, which is patchy with areas of low natural abundance. Gaps, where the likelihood of population occurrence is low, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. Opportunities exist for subpopulations over most of the species range to interact as a metapopulation, but some subpopulations are so disjunct that they are essentially isolated from other populations. Alternatives S1 and S2 would not have discernibly different effects on these conditions.

Great gray owl populations are naturally disjunct as a direct result of the scattered nature of suitable meadow habitats. Because of the dispersal ability of the species, populations are not likely to be completely isolated, even if disjunct. Alternatives S1 and S2 would result in a slight improvement in populations, because they require species surveys in response to reliable sightings. Such surveys would increase the potential for identifying and protecting new territories. Both alternatives would continue to support breeding at known sites and allow development of suitable habitat at other sites.

4.3.2.7. Foothill Yellow-Legged Frog

Factors Used to Assess Environmental Consequences

The FEIS identified eight factors that affect habitat and populations of the foothill yellow-legged frog. Of these, four would be unaffected by the proposed alternatives: chemical toxins (i.e. locally applied pesticides and herbicides), dams and diversions, mining, and recreation. The effects of these factors on this species are discussed in the SNFPA FEIS (volume 3, chapter 3, part 4.4, pages 209-210).

The FEIS noted that water development has been the most significant factor limiting populations of the species. The Forest Service has the opportunity to address the effects of water development on the national forests during the relicensing process conducted by the Federal Energy Regulatory Commission (FERC).

The four factors applicable to evaluation of the alternatives are listed below.

1. Livestock grazing
Measures: potential for direct effects to individuals, protection of riparian habitat

2. Prescribed fire
Measure: protection of suitable habitat

3. Vegetation management and mechanical fuel treatment
Measure: protection of suitable habitat

4. Roads
Measure: roads in riparian areas, stream crossings

Analysis Assumptions and Limitations

Three CARs have been established on the Sierra Nevada national forests for foothill yellow-legged frogs. Goals and objectives for CARs are identical under Alternatives S1 and S2. CARs require additional consideration of effects on this species from proposed projects, which will better ensure that potential adverse effects are fully considered and avoided or mitigated to the extent possible. Additional populations have been located on the Tahoe National Forest, although CARs have not been designated for them at this time. Local analyses will evaluate the need to establish CARs around those or other newly discovered populations.

No CARs for this species are located within the HFQLG Pilot Project Area. Management for anadromous fish species on the Lassen National Forest will result in some potential benefit to this species by managing and maintaining riparian conditions and water quality.

In general, implementation of the AMS, which is part of Alternative S1 and S2, should provide protection of foothill yellow-legged frogs and their habitat. Some discretion is allowed at the project level to implement management activities, including vegetation treatments in RCAs. Treatments in RCAs would be designed to meet riparian conservation objectives (RCOs) and would seek to balance short-term effects of management with long-term benefits. The elevation range for the species includes areas of the national forests that have the highest priority for vegetation/fuels treatment; however, the required RCO analyses will assess the effects of treatments on the foothill yellow-legged frog and its habitat in the short or long-term.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 208-212.

Livestock Grazing

Potential effects of livestock grazing are primarily direct mortality to adults, eggs, or tadpoles from trampling at water sources. The risk to adult frogs is low to moderate for tadpoles, because they are mobile; risk to eggs is highest, because they are typically fixed to aquatic vegetation along the edges of water sources.

A standard and guideline in Alternative S2 allows managers to locally test effects of different standards for forage utilization, where range is currently in good to excellent condition. Development of these local tests would require an evaluation of effects to this species, and where effects are anticipated, changes to the study and appropriate mitigation measures would be considered. In general, the effects of livestock grazing within the range of the species, which are more fully described in the FEIS, would be the same under Alternative S1 and S2.

Prescribed Fire

Both alternatives include a standard and guideline to prevent prescribed fires from being ignited in riparian areas. The intent is to minimize damage or loss of riparian vegetation. Prescribed fire backing downslope into riparian areas would burn under lower intensities than fires that were ignited in the bottom of riparian areas and allowed to burn upslope. Prescribed burning has the potential to remove coarse woody debris and surface material that may be used for shelter by dispersing individual frogs. The loss of coarse woody debris is especially likely where surface fuel levels are high. Where prescribed fire is used as a follow-up treatment to a mechanical fuels treatment, i.e. where surface fuel levels have been lowered, retention of coarse woody debris is more likely. Prescribed burning in the fall is more likely to result in loss of coarse woody debris, because fuel moisture typically is low and consumption of material is more complete.

Alternative S1 would involve more use of prescribed fire as the primary fuels reduction method, because it is the preferred treatment type in several areas. Alternative S2 would allow mechanical treatments to be substituted in many of these same areas, where equipment use is suitable (generally on slopes less than 35% with road access). The effects of equipment use are described in the following section.

Vegetation Management and Mechanical Fuel Treatments

Mechanical fuels treatments would be carried out under both alternatives; more extensively under Alternative S2. Mechanical equipment would typically be used during the dry season (late spring through late fall) when foothill yellow-legged frogs are least likely to be dispersing, resulting in a minimal risk of direct mortality from crushing. Equipment use during the dispersal season could result in a slight risk of direct mortality if dispersing frogs sheltered underneath equipment tires or tracks when equipment was idle. This risk would be dependent upon the location and distance of equipment from the nearest occupied frog habitat.

Fuels treatments in upland areas will change the microclimate within stands that may be used for dispersal during the spring and fall. How these changes would affect the species' ability to disperse through treated stands is unknown. In addition to microclimate changes, thinning within stands may change the visibility of dispersing frogs to predators, although the extent of this effect is unknown.

Alternatives S1 and S2 involve the same direction for management of riparian areas—the AMS. Vegetation management and mechanical fuels treatments in riparian areas would be guided by RCOs that are formulated to reflect the potential impacts and benefits of actions on aquatic and riparian resources. Although the vegetation and fuels treatments differ between the alternatives, effects on riparian areas are expected to be similar and be as described in the FEIS.

Roads

The difference in road construction between Alternatives S1 and S2 is attributed to the HFQLG Pilot Project. It has been estimated that up to 100 miles of new road construction may be needed in the HFQLG Pilot Project, primarily for access to group selection units. This rate of road construction and its effects were analyzed the HFQLG FEIS. A smaller amount of additional road construction (approximately 15 miles per decade across the bioregion) is projected to be needed outside of the HFQLG area, primarily as extensions of existing roads for access to mechanical vegetation treatments. Ongoing road decommissioning is likely to compensate for new road construction, especially over time. In general, standards and guidelines for new road construction will reduce the likelihood that sediment production will adversely affect streams. During the biological evaluation process, proposed new road construction in the proximity of known or suspected occupied habitat will be analyzed. Application of the AMS and SAT guidelines will guide managers to identify existing roads that may be adversely affecting this species.

HFQLG Pilot Project

By law, the SAT guidelines would be applied to the HFQLG Pilot Project Area during the life of the project and the AMS would be applied thereafter. The effects of implementing the SAT guidelines are discussed in the HFQLG FEIS and biological evaluation, and the effects of implementing the SAT guidelines in lieu of the AMS are discussed in the SNFPA FEIS and biological evaluation. The SAT guidelines and AMS provide similar levels of protection for riparian vegetation and condition and are expected to provide similar levels of protection of riparian areas where this species may occur.

Cumulative Effects

Habitat

Currently, suitable habitats for the foothill yellow-legged frog are mostly patches which exist in low abundance. Gaps, where suitable habitats are either absent or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunities for species interactions on the national forests. Opportunities exist for subpopulations in most of the species' range to interact as a metapopulation, but some subpopulations are so disjunct or have such low density that they are essentially isolated from other populations. Effects on this species would be similar under both alternatives.

The AMS applied in RCAs requires that fuels and vegetation management treatments and prescribed burns be designed to minimize disturbance of ground cover and riparian vegetation. In addition, direction for CARs and occupied or essential habitat for threatened, endangered, or sensitive species allows only backing fire in riparian areas. Therefore, minimal direct changes in riparian vegetation are expected. The SAT guidelines applicable to the HFQLG Pilot Project provide similar protection from adverse effects of treatments.

Population

Habitat and population conditions currently restrict the potential distribution of this species, which is highly isolated with very low abundance. Gaps, where population occurrence is low, are large enough to nearly preclude interactions and create strong potential for extirpations and little likelihood of recolonization. Both Alternative S1 or S2 would likely maintain the species' populations by protecting known occurrences and should allow for increases in populations by protecting and developing suitable habitat.

The foothill yellow-legged frog occurs primarily in lower elevation riparian ecosystems. This species has been extirpated from an estimated 66% of its historical range, due principally to water and hydroelectric development, grazing, and urbanization that adversely affect sediment and stream flow regimes.

Continued expansion of human presence within the foothills of the Sierra Nevada and its associated water use patterns, coupled with agriculture within its historical range, will continue to limit this species population outside of the national forests.

4.3.2.8. Mountain Yellow-Legged Frog

Factors Used to Assess Environmental Consequences

The FEIS identified four factors that affect habitat and populations of the mountain yellow-legged frog. Of these, two would be unaffected by the proposed alternatives: chemical toxins (i.e. locally applied pesticides and herbicides) and exotic fish stocking. The effects of these factors on this species are discussed in the SNFPA FEIS (volume 3, chapter 3, part 4.4, pages 214-215). The two factors applicable to evaluation of the alternatives are as follows.

1. Livestock grazing and pack stock use
Measure: exclusion from occupied habitat

2. Recreational activities
Measure: protection of riparian habitat

Analysis Assumptions and Limitations

Twenty-one CARs have been established on the Sierra Nevada national forests for the mountain yellow-legged frog. Goals and objectives for CARs are identical under Alternatives S1 and S2. CARs require additional consideration of how proposed projects affect this species, and this will better ensure that potential adverse effects are fully considered and avoided or mitigated to the extent possible. Additional CARs may be established as new populations are discovered.

In general, implementation of the AMS, which is part of Alternative S1 and S2, should provide protection of mountain yellow-legged frogs and their habitat. Some discretion is allowed at the project level to implement management activities, including vegetation treatments, in RCAs. Treatments in RCAs would be designed to meet riparian conservation objectives (RCOs) and would seek to balance short-term effects of management with long-term benefits. Within the species' elevation range (4,500 – 12,000+ feet) treatments in RCAs would probably be limited, because excessive fuels are a higher priority in the lower elevations. The required RCO analyses would assess the effects of treatments on the mountain yellow-legged frog and its habitat in the short- and long-term.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 214-217.

Livestock Grazing and Pack Stock Use

Mountain yellow-frogs will indirectly benefit from standards and guidelines governing livestock grazing in Yosemite toad habitat where the two species' habitats overlap. Under Alternative S1, livestock and pack stock would be excluded from occupied or essential habitat for the Yosemite toad. Alternative S2 includes an option for managers to either exclude livestock from occupied or essential habitat for Yosemite toad or develop a site-specific management plan to minimize impacts to its habitat. This direction does not apply to pack stock. Under Alternative S2, the effects of pack stock use would be analyzed during project planning and effects mitigated based on site specific conditions.

Recreation Activities

Trails used by hikers, pack stock, and livestock are commonly located in meadows occupied by this species. The direct effect from use of trails is some level of trampling of adults, juveniles, and metamorphs. Alternatives S1 and S2 include direction to assess trails as part of implementing RCA standards and guidelines and to take correction action where problems are occurring. The risk to adults is likely low due to their larger size and mobility. Risks are higher for metamorphs due to their small size and their habit of freezing in place when threatened.

Indirect effects of poor trail location in meadows include changes in meadow hydrology, which can adversely affect occupied habitat by drying meadows or increasing sedimentation. It is not known how many trails are in this condition. Trail management emphasis is placed on evaluating trails in meadows and riparian areas and trail maintenance and trail re-location are common practices.

Off-highway vehicle use may also have direct and indirect effects similar to those described for trails. Alternatives S1 and S2 provide sufficient direction to guide corrective actions for any adverse effects that may be occurring from this activity.

HFQLG Pilot Project

By law, the SAT guidelines would be applied to the HFQLG Pilot Project Area during the life of the project and the AMS would be applied thereafter. The effects of implementing the SAT guidelines are discussed in the HFQLG FEIS and biological evaluation, and the effects of implementing the SAT guidelines in lieu of the AMS are discussed in the SNFPA FEIS and biological evaluation. The SAT guidelines and AMS provide similar levels of protection of riparian vegetation and condition and are projected to provide similar levels of protection of riparian areas where this species may occur.

Cumulative Effects

Habitat

Currently, suitable habitats for the mountain yellow-legged frog are mostly patches which exist in low abundance. Gaps, where suitable habitats are either absent or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunities for species interactions on the national forests. Although opportunities exist for subpopulations in most of the species range to interact as a metapopulation, some subpopulations are so disjunct or have such low density that they are essentially isolated from other populations. Effects on this species would differ little between the alternatives.

Habitat is available for this species across its range; however, the presence of introduced fish has greatly reduced populations and limits recovery and/or re-population of suitable habitats. Alternatives S1 and S2 include direction to establish cooperative efforts between the Forest Service and the California Department of Fish and Game to remove fish from some occupied sites. Also, both alternatives would require the development of a conservation assessment for this species. Physical habitat characteristics such as water depth and water temperature would not be expected to change as a result of implementation of either alternative. Cover for frogs may be slightly reduced by grazing of livestock and pack stock under either alternative; however, this effect would be insignificant when considered across the entire range of the species.

The intensity and amount of mechanical treatment and resulting potential for habitat alteration in uplands would be slightly greater under Alternative S2 than under Alternative S1. The overall effects would be similar because the same areas would be treated. Alternative S2 is projected to result in a slight reduction in the risk of high severity wildfire by achieving more effective treatments on more acres in a shorter timeframe than Alternative S1. Given the restrictions on treatment in riparian areas, wildfires generally pose a greater risk to habitat.

Population

The mountain yellow-legged frog was once the most common amphibian in high-elevation aquatic ecosystems of the Sierra Nevada. Habitat and population conditions currently restrict the potential distribution of this species, which is highly isolated with very low abundance. Gaps, where population occurrence is low, are large enough to nearly preclude interactions and create strong potential for extirpations and little likelihood of recolonization. Implementation of either Alternative S1 or S2 would be likely to improve the species' populations by protecting important known sites in CARs.

4.3.2.9. Yosemite Toad

Factors Used to Assess the Environmental Consequences

The FEIS identified four factors that affect habitat and populations of the Yosemite toad. Of these, two would be unaffected by the proposed alternatives: chemical toxins (i.e. locally applied pesticides and herbicides) and exotic fish stocking. The effects of these factors on this species are discussed in the FEIS (volume 3, chapter 3, part 4.4, pages 219-220). The two other factors were considered separately in the FEIS but are considered together here.

1. Livestock grazing and pack and saddle stock use
Measure: exclusion from occupied habitat

2. Recreational activities
Measure: protection of riparian habitat

Analysis Assumptions and Limitations

Little information exists about the effects of land management activities on the Yosemite toad. The analysis of habitat effects here is based upon general ecological relationships of mountain meadow ecosystems. The effects of recreation are similarly extrapolated from studies on the effects of these activities to riparian meadows.

Standards and guidelines for both Alternatives S1 and S2, together with the guidelines for biological evaluations for projects, provide substantial direction to protect Yosemite toads and their habitat.

Some roads travel through or adjacent to meadows occupied by Yosemite toads. RCA standards and guidelines applicable to both alternatives require assessment of impacts of roads and corrective action as necessary at the project level. However, the number of meadows occupied by Yosemite toads that have roads is relatively small; most occupied meadows are unroaded and in wilderness areas. Corrective actions where habitat is degraded would be taken commensurate with actual or potential effects on Yosemite toads.

The FWS, in its 12-month finding in response to a petition for listing of the species as *threatened*, attributed declines in the distribution and abundance of Yosemite toads primarily to the cumulative effects of habitat degradation, airborne contaminants, and drought. Although the FWS found that listing was warranted, such listing was precluded by other higher priority listing actions. Because airborne contamination and drought are beyond the control of the Forest Service, these factors are considered only for analysis of cumulative effects. Only the factor of habitat degradation as it relates to livestock grazing, is evaluated for this species in detail.

Five CARs have been identified for this species on the Humboldt-Toiyabe and Inyo National Forests. Additional populations on the Stanislaus National Forest are known to be present; however, CARs have not been designated for them. Local analyses will determine the need to establish CARs around those populations.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 219-222.

Livestock Grazing and Pack and Saddle Stock Use

Alternatives S1 and S2 are designed to provide protection for toads during the breeding and rearing seasons (with dates determined locally) by excluding livestock grazing from standing water, saturated soils in wet meadows, stream channels, and springs in occupied toad habitat. If physical exclusion of livestock from these water features is impractical, then livestock would be excluded from the entire meadow until it has been dry for two weeks. Under Alternative S2, in lieu of exclusion, site-specific management plans could be developed to minimize impacts to Yosemite toad and its habitat through management of livestock movement around wet areas. Such plans would include annual systematic monitoring of habitat conditions, toad occupancy, and population dynamics at sampling sites. In addition, the adaptive management strategy of Alternative S2 would allow for development of studies on a number of allotments that would examine alternative management strategies including a site-specific monitoring and biological evaluation component.

The *rearing season* under both alternatives is defined to include periods of egg and tadpole life stages until the tadpoles emerge from their breeding pools and metamorphose into terrestrial juveniles (metamorphs). Use of this definition would generally protect the egg and tadpole life stages from direct effects from livestock. However, the rearing season can vary considerably each year as it is dependent upon yearly weather patterns and surface water conditions. The rearing season will be evaluated annually, because livestock grazing management based upon fixed calendar dates could result in destruction of eggs and tadpoles in years when breeding is delayed. Information from the adaptive management study under Alternative S2 could provide insight about this risk and the risk to metamorphs.

Under Alternative S1, this direction would also be applied to pack and saddle stock under commercial permit. Alternative S2 does not include specific direction for management of pack and saddle stock in occupied or essential habitat for Yosemite toads; management direction would be deferred to the project level. Although direction for pack and saddle stock grazing is not provided in Alternative S2, effects must still be evaluated during biological evaluations prepared during project analyses. Thus, the primary difference between the alternatives would be in the timing of consideration of effects. Under Alternative S2, effects would be considered as projects became ripe for decision, and some existing special use permits that authorize pack stock grazing would not be automatically evaluated until those permits became due for renewal. Site-specific analysis permits would re-evaluate and identify corrective actions that could be taken, which may involve altering pack or saddle stock use. At this time, the specific contribution of pack and saddle stock use to the risk of direct mortality of toads from trampling is unknown. The conservation assessment currently under preparation for this species will better define the risk of toad trampling from pack and saddle stock.

Under both alternatives, due to the difficulty of herding livestock and/or building and maintaining fencing in many of the high elevation meadows, livestock grazing and movement will take place in some percentage of Yosemite toad breeding and rearing areas, if livestock are allowed to graze in adjacent portions of allotments. The potential direct effect on the Yosemite toad is trampling of some egg masses and tadpoles in shallow portions of ponds, causing mortality by livestock that unintentionally drift into breeding areas. However, most egg masses will have hatched by the time livestock are in these high elevation meadows so such effects would occur primarily during the tadpole stage.

Metamorphs, juveniles, and adult toads are highly exposed to direct trampling mortality as a result of livestock grazing anywhere in meadows after the breeding and rearing season has ended. Metamorphs are most vulnerable, because they move very slowly or stop moving when approached. This risk is highest from July through October, depending upon elevation and weather. Other direct effects that have been reported include entrapment of metamorphs in deep livestock hoof prints, toads being buried by livestock fecal matter, and possible entrapment of toads in rodent burrows that have collapsed from livestock hooves. It is not known how mortality from these situations affects overall population stability.

Indirect effects which are possible from implementation of Alternatives S1 and S2 include modification of breeding and rearing pool structural features by punching and chiseling of livestock hooves. These modifications can cause egg masses to sink into deeper water where the probability of mortality is increased. Under both alternatives, trampling and matting of vegetation would reduce cover for metamorphs, juveniles, and adults and may increase their vulnerability to predation from birds and snakes. Unpublished data (Martin, personal communication 2003) suggests that contamination of breeding and rearing pools by livestock fecal matter may delay metamorphosis of tadpoles and result in smaller metamorphs, compared to habitats where livestock are absent. Livestock grazing and trailing can alter meadow hydrology of breeding and rearing pools by causing meadows and pools to dry before toads can successfully complete metamorphosis. The extent that this process is occurring, and the potential for this process to occur, has not been evaluated within the occupied range of the Yosemite toad.

Grazing has occurred throughout Yosemite toad habitats for well over 150 years, and hundreds of toad populations persist to this day where livestock grazing continues. Historical data about toad populations from which to assess past effects of grazing practices in the late 19th and early- to mid-20th centuries does not exist. Thousands of sheep and cattle are known to have grazed portions of the Yosemite toad's range, and meadow degradation has been documented in photos and agency reports. Yosemite toad habitats were probably adversely affected by stream channel incision and subsequent meadow desiccation during this period. It is possible that in some areas toad habitats may be recovering from these past changes. In the last 10 to 20 years, the number of active allotments has decreased and management within allotments has increased focus on managing wet meadows and sensitive aquatic areas which has resulted in improvement in conditions at some Yosemite toad sites.

Under Alternative S1 and S2, species surveys of suitable unoccupied habitat would be required to be completed within a specific timeframe. Surveys of Yosemite toad habitat within range allotments are estimated to be complete by the end of 2004. Under Alternative S1, if surveys are not completed by January 2004 (3 years of the signing of the ROD), standards and guidelines restricting livestock restriction would apply to all unsurveyed suitable meadows. Under Alternative S2, an additional two years from the signing of the new ROD would be available to complete the required surveys. Restriction of grazing in unsurveyed suitable habitat would not be required.

Recreation Activities

Trails used by hikers, pack stock, and livestock are commonly located in meadows occupied by Yosemite toads. The direct effect of use of trails by hikers may lead to some trampling of adults, juveniles, and metamorphs. Metamorphs are particularly vulnerable because of their small size. Alternatives S1 and S2 include direction to assess trails as part of implementing RCA standards and guidelines and to take correction action where problems are occurring.

Indirect effects of poor trail location in Yosemite toad habitat include changes in meadow hydrology which can dry meadows or increasing sedimentation. The overall effect of these processes on Yosemite toad populations is unknown.

Off-highway vehicle use may also directly and indirectly affect Yosemite toads similarly to trails, at least in low elevation areas. However, most Yosemite toad populations are found in unroaded and wilderness areas where little or no such use occurs.

Herger-Feinstein Quincy Library Group Pilot Project

This species does not occur within the HFQLG Pilot Project Area.

Cumulative Effects

Habitat

Under both Alternative S1 and S2, suitable habitats for Yosemite toads would be either broadly distributed or highly abundant across the historical range of the species on the national forests. However, gaps exist where suitable habitats are absent or are only present in low abundance. The disjunct areas of suitable habitats are typically large enough and close enough to permit dispersal of individuals among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range.

Ongoing surveys, initiated with the FEIS ROD, continue to identify new meadows occupied by Yosemite toads, as well as a numerous suitable meadows that have structural characteristics suitable for toad occupancy. As surveys continue, additional new sites are expected to be found in the next few years. Survey results to date reveal that habitats are well distributed, suitable, and should provide for interaction of populations on the national forests where they occur.

Under Alternative S1 and S2, all important known occupied habitats would be maintained, and surveys of suitable unoccupied habitats to determine occupancy would be completed. Both alternatives also include direction for restoration of wet meadow habitats as part of the AMS.

Climate change or short-term weather variability may affect the distribution of habitats over the planning period. Some researchers hypothesize that lower elevation habitats are gradually drying and possibly becoming less suitable for occupancy by toads. If this hypothesis proves to be true, lower elevation habitats will trend away from the favorable conditions described above for the species habitat in general.

Population

Over the last decade, the results of presence/absence surveys in suitable habitat throughout the range of the species suggest that population outcomes would be similar for both alternatives. Based on survey results to date, habitat and population conditions currently restrict the distribution of the species, to the point that some subpopulations are likely to become isolated and/or have very low abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or nonexistent are large enough that opportunities for interactions among populations are limited. Because only limited information is available about historical population densities and distribution, the degree to which the current population distribution coincides with the historical range of the species is unknown.

Surveys conducted to date have documented low numbers of adult Yosemite toads per occupied site. The FWS' 12-month findings on a petition for listing the species as *threatened* determined that such listing is warranted but is precluded by other listing priorities. The decline in the distribution and abundance of Yosemite toads was one reason for the determination. The overall threat to the species is moderate.

If more populations are found as additional surveys are completed and monitoring of toad populations continues, the expected population outcomes described above for both alternatives may improve somewhat. Additional occupied habitat could indicate that the species distribution is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or nonexistent may still be large enough that some subpopulations are isolated, limiting opportunity for species interactions. Under these conditions, opportunities may exist for subpopulations in most of the species' range to interact as a metapopulation, but some populations would be so disjunct or of such low density that they would essentially be isolated from other populations. In combination with the other factors mentioned above, livestock grazing in occupied meadows where the species has not been discovered may contribute to localized extirpations, if the numbers of adult toads are already very low due to undetermined causes.

Multiple factors that have historically adversely affected Yosemite toad populations and are likely to do so in the foreseeable future include pesticide drift, airborne industrial and automotive pollution, all forms of livestock grazing, disease and parasites, dams and water diversions, timber harvesting that affects streams and meadows, recreational and other human disturbance activities in toad breeding areas, off-highway vehicles, UV-B radiation, introduced fish, extreme weather patterns, and climate change. These factors may operate synergistically at multiple scales to extirpate local populations of the species, reduce population numbers, and decrease habitat suitability. The extent to which such adverse synergy is occurring is unknown. A thorough review of these factors can be found in the FWS's 12-month response to a petition to list the species, which was published in the Federal Register (volume 67, number 237) on December 10, 2002.

4.3.2.10. Northern Leopard Frog

Factors Used to Assess Environmental Consequences

The FEIS identified three factors that affect habitat and populations of the northern leopard frog. Of these, two would be unaffected by the proposed alternatives: chemical toxins (i.e. locally applied pesticides and herbicides) and exotic fish stocking. The effects of these factors on this species are discussed in the FEIS (volume 3, chapter 3, part 4.4, pages 226-227). The factor considered here to compare effects of the alternatives is:

1. Livestock grazing
Measure: potential for direct effects to individuals, protection of riparian habitat

Analysis Assumptions and Limitations

No CARs have been established for this species; however, local managers could establish CARs as appropriate in response to new information.

Because the current distribution of northern leopard frogs does not overlap with the distribution of the Yosemite toad, changes in the livestock grazing standards and guidelines to protect the Yosemite toad under Alternative S2 would not affect this species.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 226-227.

Livestock grazing

Potential effects of livestock grazing are primarily direct mortality to adults, eggs, or tadpoles from trampling at water sources. The risk to adult frogs is relatively low because they are mobile; risk to eggs is highest because they are typically fixed to aquatic vegetation along the edge of water sources.

A standard and guideline in Alternative S2 allows managers to locally test effects of different standards for forage utilization, where range is currently in good to excellent condition. Development of these local tests would require an evaluation of effects to this species, and, where effects are anticipated, changes to test study and mitigation measures would be considered. In general, the effects of livestock grazing within the range of the species, which are more fully described in the FEIS, are expected to be the same under both alternatives.

Herger-Feinstein Quincy Library Group Pilot Project

The biological evaluation for the HFQLG FEIS resulted in a determination that the pilot project would have no effect on this species.

Cumulative Effects

Habitat

Currently, suitable habitats for the northern leopard frog are mostly patches which exist in low abundance. Gaps, where suitable habitats are either absent or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunities for species interactions on the national forests. Opportunities exist for subpopulations in most of the species' range to interact as a metapopulation, although some subpopulations are so disjunct or have such low density that they are essentially isolated from other populations. Effects on this species would essentially be the same for both alternatives.

Alternatives S1 and S2 include the AMS, which should result in improved aquatic and riparian conditions in the future. In addition, a conservation assessment would be developed for this species which will help identify site specific risks that should be further evaluated during project-level planning.

Population

Habitat and population conditions currently restrict the potential distribution of this species, which is highly isolated with very low abundance. Gaps, where population occurrence is low, are large enough to nearly preclude interactions and create strong potential for extirpations and little likelihood of recolonization. Conditions after implementation of either Alternative S1 or S2 would not be discernibly different from the current condition.

Populations of this species have significantly declined in the Sierra Nevada portion of its range. No populations of this species are currently known to exist on national forest in the Sierra Nevada. If a population is discovered, a CAR would likely be established.

4.3.2.11. Cascades Frog

Factors Used to Assess Environmental Consequences

The FEIS identified four factors that affect habitat and populations of the Cascades frog. Of these, three would be unaffected by the proposed alternatives: chemical toxins (i.e. locally applied pesticides and herbicides), exotic fish stocking, and fire suppression/exclusion. The effects of these factors on this species are discussed in the FEIS (volume 3, chapter 3, part 4.4, pages 223-224). The factor considered here to compare the effects of the alternatives is:

1. Livestock grazing
Measure: potential for direct effects to individuals, protection of riparian habitat

Analysis Assumptions and Limitations

Two CARs have been established for this species around the two known reproducing populations on the Lassen National Forest. Goals and objectives for the CARs would be the same for both alternatives. CAR status requires that effects on this species of proposed projects will be more thoroughly scrutinized, which will better ensure that adverse effects are avoided or mitigated to the extent possible. Because of the limited extent of known populations on the national forests, if additional populations are located, CARs could be established to protect them.

Direct/Indirect Effects of the Alternatives

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 3, chapter 3, part 4.4, pages 223-225.

Livestock grazing

Where grazing has been limited, frog populations remain healthy. However, where habitat has been and continues to be heavily grazed, populations are typically lower and populations may be at risk of extirpation due to natural fluctuations in environmental conditions.

Currently, livestock are not grazing within the two CARs established for this species. Livestock have not been grazed for 15 years at one site, and grazing was eliminated five years ago from the other site. Because these allotments still exist, they could be grazing in the future. However, future decisions to allow livestock grazing on these allotments would be predicated in part upon an analysis of effects to this species. NEPA compliance during the allotment planning process would be required. These processes would provide opportunities to incorporate protection of populations and their habitat.

Because of the absence of livestock grazing in these CARs, even though standards and guidelines for livestock grazing differ slightly between the alternatives, no adverse effects on this species from grazing is anticipated.

Herger-Feinstein Quincy Library Group Pilot Project

Under the HFQLG Act, the SAT guidelines would be applied to the HFQLG Pilot Project Area during the life of the project and the AMS would be applied thereafter. The effects of implementing the SAT guidelines are discussed in the HFQLG FEIS and biological evaluation, and the effects of implementing the SAT guidelines in lieu of the AMS are discussed in the SNFPA FEIS and biological evaluation. The SAT guidelines and AMS provide similar levels of protection of riparian vegetation and condition and are projected to provide similar levels of protection of riparian areas where this species may occur.

The effects of implementing the HFQLG Pilot Project have been analyzed in the biological evaluation for the HFQLG FEIS, which concluded that implementation of the SAT guidelines would generally maintain and improve aquatic and riparian habitats.

Within the HFQLG Pilot Project area, CARs will not be explicitly managed until completion of the project. Goals and objectives for these CARs are the same for Alternatives S1 and S2. CAR designation requires consideration of effects of proposed projects on this species.

Cumulative Effects

Habitat

Currently, suitable habitats for the Cascades frog are distributed mostly in patches which exist in low abundance. Gaps, where suitable habitats are present in low abundance are large enough that some subpopulations are isolated, limiting opportunities for species interaction on the national forests. Alternative S1 and Alternative S2 would not change these current conditions.

This prognosis is based upon the analysis in the FEIS (volume 3, chapter 3, part 4.4, pages 224-225). Cascades frogs still occur in variously-sized populations at specific locations on the Lassen National Forest, where they were historically found. Suitable habitat remains within the drainages where the species is found. Two CARs have been established for the known reproducing populations there. These sites are currently not grazed by livestock. Effects on this species would not differ between the alternatives.

Population

Habitat and population conditions currently restrict the potential distribution of this species, which is patchy in low abundance. Gaps, where population occurrence is low, are large enough to isolate some subpopulations, limiting opportunities for species interactions. Opportunities exist for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct that they are essentially isolated from other populations. Conditions after implementation of either Alternative S1 or S2 would not be discernibly different from the current condition.

The Cascades frog remains distributed throughout the Cascade Range from northern California to northern Washington. Populations appear to vary from historical levels, with some isolation occurring.

4.3.3. Management Indicator Species

This section describes the effects of Alternatives S1 and S2 on management indicator species (MIS). The environmental effects of Alternatives F2-F8 are disclosed in the FEIS in volume 3, chapter 3, part 4.1 and 4.5 and appendix R. MIS on the Sierra Nevada national forests were described in chapter 3. Many of the MIS are also neotropical migratory birds, which are additionally evaluated in section 4.3.4.

Site-specific information does not exist about species distributions and population levels at the individual national forest level for most MIS that do not have special status (e.g. threatened, endangered, or sensitive). Where population information does exist, it is typically inadequate for making cause and effect evaluations about specific land management activities or for comparing the effects of activities on public lands to those on private lands. Given the lack of information and the programmatic nature of the alternatives, it is not possible to predict quantitative changes to populations as a result of implementing the proposed alternative. The SEIS analysis uses the projected changes in habitat to highlight differences in effects between the alternatives and to compare the potential effects of the alternatives to current conditions. Broad changes in habitat availability are evaluated at both the project scale and at the bioregional scale to identify trends that are likely to affect individual species populations.

Alternatives S1 and S2 propose to treat essentially the same areas. The primary difference between them is the intensity of treatment within treated areas. Changes in habitat availability and capability and thus effects to MIS species are likely to be similar. To evaluate short-term effects, computer modeling of habitat changes was used to assess the habitat conditions under the alternatives after all initial treatments would be completed (20 years). Habitats were also modeled after a period of 14 decades, to simulate potential long-term habitat change as a result of the initial treatments. Given the limitations inherent in habitat modeling, especially for projecting long-term habitat changes (see appendix B in the FEIS and appendix B of the SEIS for discussions of the models used and their limitations), projections were used only to evaluate the relative difference in effects between the alternatives for species or group of species.

Given the programmatic nature of this analysis, the analysis of affected habitat is approximate. Project-level decisions will determine the habitat types that will be affected. The pattern of treated areas is central to the fuels strategy of both alternatives because they are based on completing a pattern of fuels treatments across the bioregion. The proportions of CWHR habitat types (aggregated by size class and canopy cover) projected to be treated under each alternative are displayed in Table 4.3.3a.

Table 4.3.3a. Proportion of Aggregated CWHR Size and Canopy Cover Classes Potentially Treated by Alternatives S1 and S2.

CWHR Aggregate	Total Bioregional Acres	Alternative S1	Alternative S2
2D	5,222	20%	21%
2M	2,632	21%	21%
2P	26,103	32%	36%
2S	66,947	26%	27%
3D	119,739	30%	30%
3M	6,395	39%	43%
3P	140,734	12%	13%
3S	67,140	29%	32%
4D	1,132406	28%	30%
4M	1,650,795	27%	31%
4P	758,005	28%	29%
4S	810,777	21%	22%
5D	15,580	19%	20%
5M	964,043	14%	14%
5P	463,254	5%	*5%*
5S	10,892	14%	14%
6	1,237,548	27%	28%
XX	49,491	29%	33%
other	4,014,539	14%	15%
TOTAL	**11,542,042**	**20%**	**21%**

(Source: USDA Forest Service, Pacific Southwest Region 2003d)

Because the overall fuels strategy involves strategically treating portions of a landscape in a pattern that is designed to reduce the overall size and intensity of future wildfires, the CWHR aggregates that fall within treatment units are determined more by this pattern than by the specific selection of particular stands because of tree size or tree canopy cover. Given this spatial selection of treatment units, the CWHR aggregates appear to be fairly evenly affected. This suggests that at a bioregional scale, proposed treatments in both alternatives would retain similar amounts and proportions of a diversity of habitats and no particular habitat appears to be disproportionately affected.

In general, standards and guidelines for Alternative S1 would result in minimal changes in CWHR size class and canopy cover such that most areas outside of the defense zone of the WUI will remain within the same CWHR aggregation immediately following treatment. The standards and guidelines in Alternative S2 allow greater opportunity for removal of trees that could result in a reduction in canopy cover. While the standards and guidelines allow the canopy cover to be reduced by up to 30% within most treated areas, the overlapping nature of the requirements for basal area retention and desired future condition and the management intent for underlying land allocations will generally result in canopy cover reductions in the range of 10-20%. This change in canopy cover will still be sufficient to result in some acres changing to a lower canopy cover class immediately following treatment, primarily because the CWHR canopy cover class breaks at 60% canopy cover and many treatments will result in post-treatment canopy cover around 50% following the removal of small understory trees. In addition, because of the way that CWHR size class is calculated, some treated areas in Alternative S2 have the potential to change to a larger size class. This is more likely in Alternative S2 than in Alternative S1 due to the ability to remove more small diameter trees, which increases the mean diameter of the remaining forest stand. Appendix B includes a discussion of this situation.

The most obvious effect within treatment units of both alternatives will be a reduction in the amount of shrubs, sapling, and seedling trees. This effect may be temporary, depending upon the extent of initial treatment and the frequency and type of maintenance. Within forested stands, where frequent maintenance is used, levels of shrubs, seedlings and saplings will likely be more limited within treatment units. Levels will have minimal change across landscapes compared to the current condition because treatments cover approximately 25% of the landscape and high levels of shrubs, seedlings and saplings occur in forested stands outside of treatment units. Within shrubfields, frequent maintenance will likely result in more diversity in age classes which may benefit shrub dependent species. MIS that depend upon these elements for one or more critical life stage may be unable to fully utilize treated units immediately following treatment. For these species, the spatial pattern and timing of treatments within a given landscape will be important to determine if effects would be likely to limit local populations. Since the strategic emphasis is largely responsible for directing the location of treatment areas, they will tend to occur in an even distribution across landscapes rather than being focused on any particular area or habitat type. This results in discontinuous areas of treatments which reduces the likelihood that implementing either alternative would result in substantial reductions in any particular habitat at the watershed scale. These changes may affect local populations of MIS within the treated units, with some species finding improved habitat conditions and others finding reduced habitat conditions based upon these canopy cover and stand structural changes. The actual effects to populations would depend upon the ability of the species to compensate for these conditions by changing territory boundaries or utilizing alternate resources (changing prey species, using less preferred habitat types, etc). These effects are hard to generalize for any particular MIS since the details of habitat relationships and ecological adaptations are not well known for most species. To the extent that the distribution and composition of habitats does not change substantially at the watershed scale, then it can be assumed that MIS species populations would be less likely to change overall as a direct result of implementing the treatment strategies of the alternatives.

For 55 of the MIS identified for analysis in table 3.2.3a (chapter 3), the CWHR personal computer database (California Department of Fish and Game 2002) was used to generate habitat relationships information for each MIS, which was applied to the modeled habitat for each decade. For each habitat type, tree size, and canopy cover aggregate, a weighting factor (i.e. none, low, medium, high) representing the relative value of that habitat aggregate for the species was applied to the acreage of projected habitat. Thus, the numeric output represents weighted habitat values (habitat utility score) and not actual acreage of suitable habitat. For some bird species, seasonal information concerning habitat use was available (summer versus winter) which reflects the importance of different habitats in different seasons.

Note that the projections of habitat utility are based only on vegetation type and seral stage (in terms of tree size and canopy closure) and not on other potential habitat requisites of particular species, such as minimum habitat area, special habitat elements like snags or cliffs for nesting, elevation zones, etc. Also, note that this bioregional level assessment does not reflect the geographic distribution of each species. Therefore, this assessment provides a *relative* assessment, comparing habitat trends between alternatives rather than accurately predicting actual acreages of suitable habitat. Modeling of these particular elements at a bioregional scale was currently not feasible for this analysis due to the limitations of the available data in the geographic information system.

For each species at the end of the 20-year period, the projected habitat utility scores for the alternatives were compared to the projected habitat utility score for the no treatment scenario (reflecting only tree growth, tree mortality, and wildfire disturbances) to determine the amount of deviation caused by the alternative. As shown in Table 4.3.3b, two species are modeled to have habitat utility scores that increased by more than 5% under Alternative S1, and 21 species showed more than a 5% increase in habitat utility scores under Alternative S2. The song sparrow showed decreased habitat utility scores under Alternative S2. When the threshold is changed to a 10% change, no species were identified under Alternative S1, and 4 species showed significant improvement under Alternative S2, as also indicated by bold in Table 4.3.3b (see footnote).

Table 4.3.3b. MIS Having Estimated Change in Habitat Utility Score of >5% in 20 Years Relative to the No-Treatment Baseline for Alternatives S1 and S2.

CWHR Species Identification Code	Species	Alternative S1	Alternative S2
B251	Band-tailed pigeon	W	S
B299	Red-breasted sapsucker		S, W
B300	Williamson sapsucker		S, **W**
B303	Downy woodpecker	Y	Y
B304	Hairy woodpecker		S, W
B305	White-headed woodpecker		Y
B308	Pileated woodpecker		Y
B320	Pacific-slope flycatcher		S
B340	Violet-green swallow		S, W
B361	Red-breasted nuthatch		S, W
B369	House wren		W
B430	Yellow warbler		S
B436	Black-throated gray warbler		S
B475	Black-headed grosbeak		S
B505	Song sparrow		- *W*
B532	Northern oriole		**S**
B537	Cassin's finch		S, **W**
B539	Red crossbill		S
M006	Ornate shrew		Y
R036	Western skink		Y
R057	Gopher snake		**Y**
R059	California mountain kingsnake		Y

Notes: S = Summer, W = Winter, Y = Yearlong
Bold indicates >10% difference. Italics indicates decreased habitat utility

The modeled effects can generally be explained by changes in several habitat factors. At year 20, Alternative S2 is projected to result in a slightly greater acreage of medium canopy cover (CWHR canopy classes M: 40–60% canopy cover) and slightly less acreage of high canopy cover (CHWR canopy class D: >60% canopy cover) than would Alternative S1. The latter trend would be reversed by year 140, when Alternative S2 would result in a slightly greater acreage of high canopy cover than would Alternative S1. Although acreage of lethal wildfire is projected to diminish under both alternatives but greater under Alternative S2, the resulting reduction in openings and early seral habitat would not be fully realized within the 20 year time period.

Both alternatives would favor development of late seral stages (older forests) and closed canopy forests (>60% canopy cover). Modeling shows that at year 140 vegetation growth in the bioregion overall would mask the initial differences between the alternatives, and the effects under both alternatives would be similar. This is primarily due to continued vegetation growth on the large untreated portion of the Sierra Nevada bioregion. While treated units continue to develop large trees, they typically retain more open canopies (< 60%) with regular fuels maintenance. The extent of continued maintenance in these same treatment units into the long-term future would affect the within stand habitat elements (amount of shrubs, seedlings, saplings, snags, and down logs), which would also influence habitat capability for individual species.

Habitat modeling for 140 years is not considered accurate enough to distinguish differences in habitat utility scores of 5%. Therefore, evaluation at 140 years was based on a criteria of a 10% change. This level was chosen as a means to discriminate habitat changes that might be triggered by the proposed treatments. Using this criteria, at year 140 under Alternative S1, 38 species showed a improved habitat utility score compared with the outcomes under no initial treatment, and 6 species showed a reduced utility score. Under Alternative S2, 35 species showed increased utility scores compared with outcomes under no initial treatment and 9 species showed a decreased habitat utility score greater than 10 percent. Increased habitat utility scores may indicate the potential for increasing population trends and negative habitat utility scores may indicate the potential for decreasing population trend although making definitive population predictions is not possible. Higher habitat utility scores likely reflect some combination of more acres of suitable habitat being available and higher habitat quality on existing acres of suitable habitat. If these conditions occur in appropriate locations and the species is distributed to take advantage of the available habitat, this could lead to increased populations. Decreased habitat utility score could lead to decreased populations if the areas of decreased habitat quality are currently occupied and the habitat quality or area of suitable habitat decreases to the point that it no longer supports the species.

To examine the relative effects on potential long-term habitat between the alternatives, the 140 year habitat utility scores were compared between the two alternatives as well as against the projected future condition with no treatment. Because only a portion of the bioregion is proposed for treatment under these alternatives, the modeled amounts of habitat in the future are still largely influenced by development of forest stands that do not receive treatment and the change in projected high severity wildfire. At 140 years, only seven species showed more than a 10% difference in habitat utility score between the alternatives. Five species show a greater benefit in habitat utility scores under Alternative S1 and two species show a greater benefit in habitat utility scores under Alternative S2 as shown in Table 4.3.3c.

Table 4.3.3c. MIS Having Estimated Difference in Habitat Utility Score of >10% Between Alternatives S1 and S2 when Compared to the No Treatment Baseline at 140 Years.

CWHR Species Identification Code	Species	Alternative S1 to Baseline	Alternative S2 to Baseline	Alternative S1 Favored over S2	Alternative S2 Favored over S1
B300	Williamson's sapsucker (W)	26%	36%		X
B369	House wren (W)	18%	35%		X
B505	Song sparrow (S)	-28%	-40%	X	
B505	Song sparrow (W)	-20%	-34%	X	
B510	White-crowned sparrow (W)	-17%	-29%	X	
M052	Mountain beaver (Y)	-15%	-28%	X	
R057	Gopher snake (Y)	5%	-7%	X	
R069	Western terrestrial garter snake (Y)	0%	-17%	X	

(S) = Summer, (W) = Winter, (Y) = Yearlong
(Source: USDA Forest Service, Pacific Southwest Region 2003d)

Much like projections of conditions for year 20, these long-range projections of differences between the alternatives are largely explainable by the differences among acreages of each habitat type and seral stage over time resulting from differences in projected lethal wildfire and simulated vegetation growth and mortality. Species that favor younger and/or more open forest stands (song sparrow, white-crowned sparrow, mountain beaver, gopher snake, and western terrestrial garter snake) are projected to have stable or decreased habitat utility scores in both alternatives. Because Alternative S2 is projected to create slightly more acres of older and more closed canopied forests at the expense of younger and more open habitats, these early seral species would have a higher reduction in habitat utility score. These projections could indicate risks of declining population trends for these species *if* the decrease in seedling and sapling habitats and more open canopy cover conditions materializes in the future. Wildfires are likely to continue to provide these early seral conditions into the foreseeable future. However, the spatial size and distribution of these areas are unpredictable and the associated effects to MIS populations cannot be accurately evaluated.

Vagaries of the habitat relationships employed, in relation to available vegetation mapping, also come into play. The house wren in Table 4.3.3c is a good example. It is most strongly tied to low and mid-elevation hardwood, hardwood-conifer, and riparian vegetation types and is not strongly associated with either large trees or areas of either open or closed canopy cover. Subtle changes in the amounts of these habitat types apparently account for the benefit to this species under Alternative S2. Because of the inherent uncertainties in projections of long-term habitat from such modeling, caution should be exercised in interpreting apparent differences between the alternatives too literally. The relationship of these habitat trends on MIS populations is highly speculative; however, it does appear that there are no obvious habitat trends that would suggest significant downward or upward population trends for MIS species directly as a result of implementing the fuels and vegetation strategies of the two alternatives.

In both the short-term (20 years) and long-term (140 years), modeling and analysis indicates neither alternative would sufficiently alter any specific habitat aggregate such that it would raise concerns for populations of individual species or groups of species dependent upon those habitats at the watershed or bioregional scale. The alternatives in this SEIS are intended as the first steps in moving Sierra Nevada ecosystems towards more ecologically sustainable conditions with abundant old trees and old forests and reduced losses from high severity wildfire. It is expected that future land management planning processes will consider the condition of forests and forest resources, naturally fluctuating environmental conditions, and the need to provide for early and mid-seral habitats and their dependent species along with old forest dependent species, in determining the next management strategies. Under the adaptive management framework of both alternatives, the ability to adjust management actions based upon the awareness of new concerns and opportunities should better ensure the maintenance of diverse habitats to support the wide variety of MIS across the national forests in the short-term.

4.3.4. Neotropical Migratory Birds

A number of the high priority land bird species occurring in the Sierra Nevada bioregion (see chapter 3) are Forest Service sensitive species and are monitored in detail. Other species are not directly monitored, except at breeding bird survey routes and Monitoring Avian Productivity and Survivorship (MAPS) monitoring sites. Several others are MIS and are monitored at varying levels. Management for neotropical migratory birds is generally accomplished by focusing on providing a diversity of habitat conditions at appropriate levels across landscapes. Both alternatives involve similar desired conditions for forest types across the Sierra Nevada and would be expected to have the same difference in effects on neotropical migratory birds.

Alternatives S1 and S2 are consistent with the interim MOU between the Forest Service and FWS. Although the MOU has expired, the guidance it provides remains pertinent and is not in conflict with the direction contained in either alternative.

Four avian conservation plans in various states of completion are pertinent to evaluating effects on neotropical migratory birds. Each conservation plan includes recommendations for habitat conservation. Direction for both alternatives is consistent with those recommendations. The avian conservation plan (identified in chapter 3) for the Sierra Nevada bioregion identified four priority habitats. Each of these priority habitats corresponds to a focus area of the SNFPA FEIS, which are also the focus areas of the SEIS. In particular, direction for management of hardwood ecosystem would be the same under Alternatives S1 and S2.

Amounts of proposed vegetation management are similar for both alternatives, with slightly more acreage being treated under Alternative S2. The direction for snags varies between the alternatives, with more flexibility for local adjustment in Alternative S2. This flexibility could benefit neotropical migratory birds, because the same snag retention goals apply as under Alternative S1, but snags may be distributed across treated areas in patterns that increase the likelihood that they would persist over time, particularly where maintenance prescribed burning is planned. Under Alternative S2, snags would generally be retained in clumps distributed irregularly across treated areas. Although the four largest snags may not be retained, retained snags are expected to be in the largest size class of snags in the area.

Under Alternative S1, small groups of trees larger than 1 acre in CWHR classes 5M, 5D, or 6 would be managed by generally limiting tree removal to trees ≤12” dbh. Alternative S2 does not include this requirement but does require limiting tree removal to smaller diameter trees, based upon other stand characteristics such as basal area and canopy cover. It also has the same 30” absolute diameter limit as Alternative S1. Because the objective for fuels treatments under both alternatives is to treat surface and ladder fuels through thinning small diameter trees, differences in changes to individual forest stands between the alternatives are difficult to predict. Under Alternative S2, the diameter limit for tree removal will likely be higher than 12” in some forest stands that meet the CWHR 5M, 5D or 6 criteria, but the extent of difference with Alternative S1 would vary locally and depend upon the individual forest stand. The variability of the treatment unit prescriptions based upon existing stand conditions should ensure that a heterogeneous condition develops across treated forest stands.

Because Executive Order 13186 includes a broad mandate to promote conservation of migratory birds, both Alternatives S1 and S2 can be considered to comply with that mandate because they focus attention on priority habitats in the Sierra Nevada bioregion, as identified in the riparian-bird, oak-woodland, and conifer-forest avian conservation plans. Management direction for both alternatives is consistent with the objective of promoting conservation of migratory birds.

The direction in the SEIS is programmatic and the effects of individual projects on neotropical migratory birds will be analyzed at the project level. Potential effects on neotropical migratory birds at the local scale include modification of habitat and disturbance/destruction of individuals from mechanical fuels treatments, hand treatments, prescribed burning, and herbicide use. More specifically, effects could involve

- mortality of young in the nest due to physical disruption or nest abandonment by the adults who are intolerant to disturbance;
- loss or adverse modification of nesting, roosting, or foraging habitat; or
- direct or indirect effects from use of herbicides.

Neotropical migratory birds are also threatened by

- long-term changes in habitat due to development in foothill habitats,
- forest vegetation changes due to climatic changes of disturbance regimes,

- forest vegetation changes due to management alteration of disturbance regimes,
- loss from wildfire,
- changes in vegetation from livestock grazing,
- human disturbance associated with land use and recreation, and
- changes to stand structure from outbreaks of insects and diseases.

Many of these species are dependent on habitats beyond the national forests for a substantial portion of their lives, and management of national forests can at most only contribute to their conservation. Under Alternatives S1 and S2, the long-term habitat effects from large, high intensity wildfires would be reduced. These fires destroy habitat locally and increase habitat fragmentation across the bioregion. This reduction in large, high intensity wildfires would tend to increase stability of old forests and patches with old forest characteristics. Some neotropical migratory bird species utilize early successional habitats that develop following wildfires. Although these habitats will form at a diminishing rate, large areas of early successional habitat will nonetheless be generated in the near term. The objective of the fuels and vegetation strategy of both alternatives is to move the Sierra Nevada towards a condition where wildfires continue to create early successional habitats but at smaller patch scales and in a more heterogeneous pattern across the bioregion, which should improve the distribution of this habitat type.

4.3.5. Endangered, Threatened, Proposed, and Sensitive Plant Species

The effects of the new information pertaining to endangered, threatened, and proposed species have been evaluated in the biological assessment was prepared for the SEIS (USDA Forest Service 2003a).

Some additional information since completion of the SNFPA FEIS pertaining to 10 species is presented in Chapter 3. This information does not substantially alter the analysis and conclusions made in the FEIS. As documented in Appendix C of the SEIS, the effects to vascular plants, bryophytes, and fungi were adequately addressed in the FEIS and further analysis is not warranted. This conclusion was based upon retention of standards and guidelines pertaining to endangered, threatened, proposed and sensitive plant species protection, noxious weeds, and special aquatic elements such as bogs and fens. In addition, the commitment to completing Conservation Assessments for the 28 highly vulnerable plant species will not change and several Conservation Assessments are currently being prepared to meet the expected rate of completion identified in the SNFPA ROD.

The effects of implementing the HFQLG Pilot Project on endangered, threatened, proposed, and sensitive plant species has been fully evaluated in the FEIS and biological evaluation for that project and are consistent with finding made in the SNFPA FEIS and its supporting biological assessment and biological evaluation. The primary protection measures used in both the HFQLG and SNFPA for plant species is the requirement for field surveys and project design features to minimize and mitigate adverse effects during site-specific project planning.

4.4. Land and Resource Uses

4.4.1. Commercial Forest Products

The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 377-384.

Allowable Sale Quantity

Under both alternatives, only the Big Valley Sustained Yield Unit of the Modoc National Forest would produce regulated timber yields. Non-regulated timber yields would result from fuel reduction projects, whenever sawtimber-sized trees were moved in numbers sufficient to create of an economically feasible timber sale contract. The greater management flexibility allowed under Alternative S2 is expected to result in a larger volume of sawtimber products. After the first 20 years, timber yields would only be derived from fuel maintenance and salvage projects. Under Alternative S2, regeneration harvest is also allowed in the HFQLG Pilot Project Area for the life of the pilot project.

Sawtimber Production

Table 4.4.1a lists the estimated average annual sawtimber volumes for the first 20 years of plan implementation under each alternative. HFQLG volumes are also provided separately. Green sawtimber harvest volumes for Alternative S1 are slightly higher than projected in the FEIS for Alternative Modified 8, the alternative selected in the SNFPA ROD. Alternative Modified 8 was originally modeled by typically locating treatment areas on the upper two-thirds slopes, on south and west aspects, in mid- and low-elevation vegetation types. Field experience and the analysis supporting the findings of the Sierra Nevada Review Team has revealed that the concept of concentrating fuels treatments on the upper two-thirds of south-facing slopes is not practical for widespread application. Thus, for this SEIS, both Alternative S1 and S2 were analyzed using an optimized treatment layout pattern that more evenly covers entire landscapes. As a result, treatments are projected to occur in areas having slightly higher average volumes per acre than in the previous modeling.

Table 4.4.1a. Average Annual Sawtimber Harvest (MMBF).

	Alternative S1			Alternative S2		
	Green	Salvage	Total	Green	Salvage	Total
Bioregion						
First 5 years	88	30	**118**	373	90	**458**
Second 5 years	52	30	**82**	286	90	**371**
First decade	70	90	**160**	330	90	**420**
Second decade	20	30	**50**	132	90	**222**
HFQLG Only						
First 5 years	53	--	**53**	254	--	**254**
Second 5 years	17	--	**17**	167	--	**167**
Second decade	0.17	--	**0.17**	55	--	**55**

Sawtimber harvest under Alternative S2 would be greater than under Alternative S1, primarily for two reasons. First, Alternative S2 would allow full implementation of the HFQLG Pilot Project. Under Alternative S1, group selection in the pilot project area would be limited to 4,000 acres per year. Alternative S2, however, allows for 8,700 acres of group selection per year as originally planned in the pilot project. Second, standards and guidelines for vegetation treatments for Alternative S2 allow for removal of more and larger trees (although still <30 inches dbh) from many treatment areas. Thus, although both alternatives were modeled using the same treatment pattern, the projected volume to be removed is greater for Alternative S2.

As shown in Figures 4.4.1a and 4.4.1b, under both Alternative S1 and S2 a decline in the volume of sawtimber harvested is projected after the first five years, and an additional reduction is projected in the second decade. After initial fuels treatments are completed, only maintenance treatments would be implemented, which would produce limited sawtimber volumes. In addition to fuels treatment, some salvage harvest would also occur. Wildfire mortality would be the primary source of sawtimber and biomass salvage. As noted in chapter 3, California residents meet about 80% of their wood product demand by importing products from other states and countries. Despite the difference between Alternatives S1 and S2, neither would provides a significant increase in available sawtimber for California markets or significantly reduce the percentage of imported wood products.

The additional timber volume generated by the HFQLG Pilot Project is limited to the time period authorized and recently extended in legislation. Subsequent harvest projections reflect the termination of this project. The second-decade reduction is more pronounced under Alternative S2, because the HFQLG Pilot Project accounts for a larger share of the harvest volume in this alternative.

Figure 4.4.1a. Projected Decadal Green Sawtimber Harvest for National Forests of the Sierra Nevada.

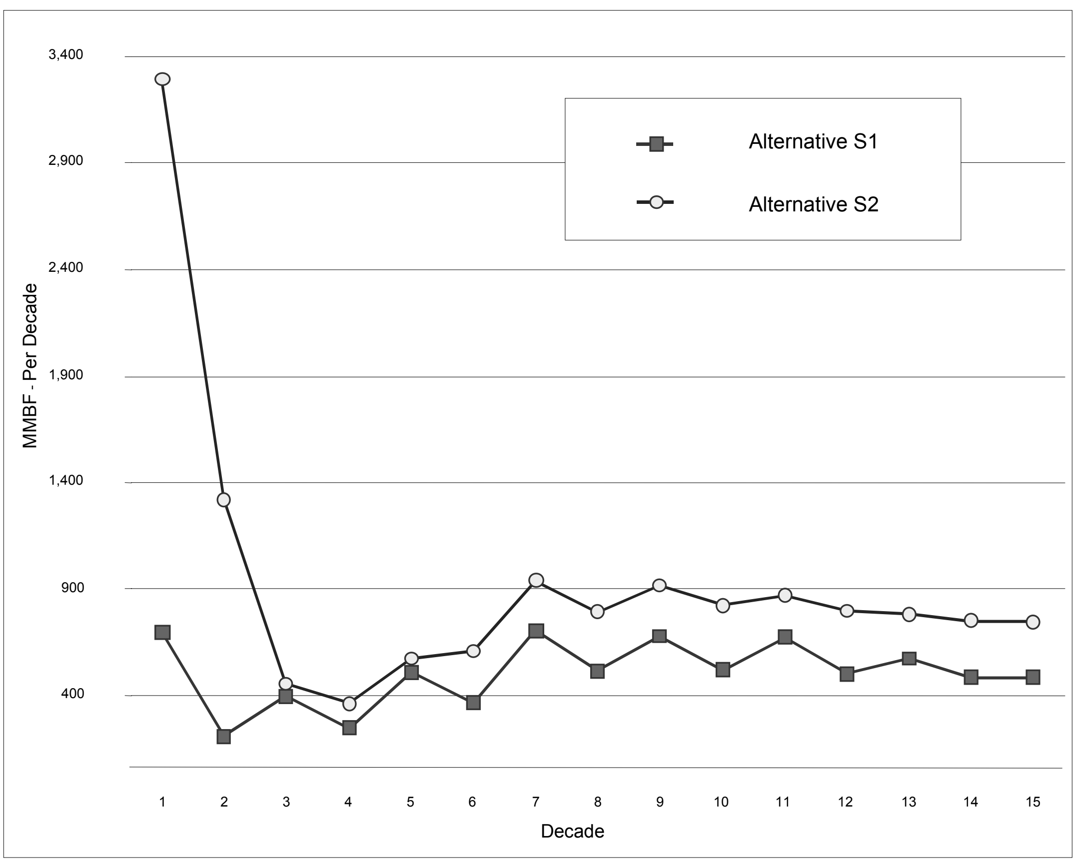
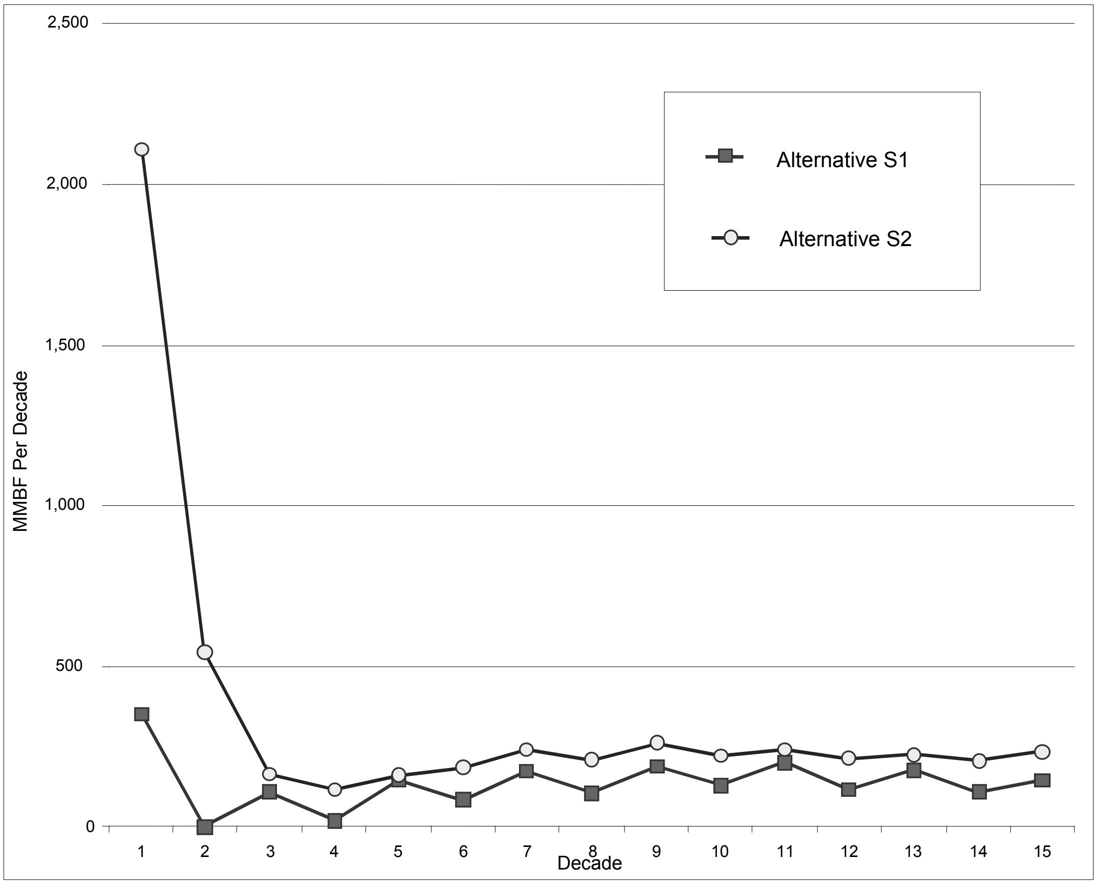


Figure 4.4.1b. Projected Decadal Green Sawtimber Harvest for the HFQLG Pilot Project Area.



(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Table 4.4.1b shows the projected harvest by national forest under Alternative S1 and S2 for the first two decades. Under both alternatives, the Plumas, Lassen, and Tahoe National Forests would account for a disproportional amount of the harvest volume, reflecting efforts to implement the HFQLG Pilot Project. Forests implementing the pilot project are projected to account for the largest share of the total regional harvest volume under Alternative S2, under which the treated acreage and the intensity of treatments would be increased in the HFQLG Pilot Project Area.

Table 4.4.1b. Projected Annual Green Timber Harvest Volume (MBF) by National Forest.

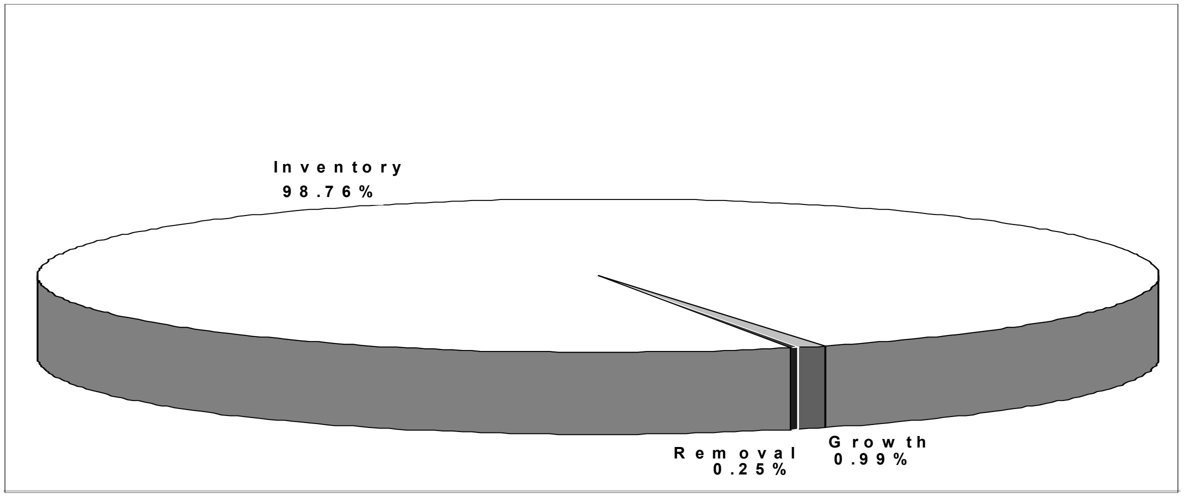
National Forest Unit	Alternative S1		Alternative S2	
	Decade 1	**Decade 2**	**Decade 1**	**Decade 2**
Sierraville Ranger District (HFQLG)	808	11	7,003	1,762
Tahoe National Forest, except Sierraville RD	4,090	18	16,867	12,646
Stanislaus National Forest	3,141	938	23,176	11,629
Giant Sequoia National Monument (GSNM)	7,425	7,700	7,425	7,700
Sierra National Forest, except GSNM	2,719	2,998	14,819	11,120
Sequoia National Forest, except GSNM	782	445	6,375	3,192
Plumas National Forest (HFQLG)	18,461	122	111,635	27,914
Big Valley Federal Sustained Yield Unit (BVFSYU)	5,485	5,485	5,485	5,485
Modoc National Forest, except BVFSYU	580	3	7,202	3,600
Lake Tahoe Management Unit	1,973	295	3,071	460
Lassen National Forest (HFQLG)	16,021	39	91,999	24,906
Inyo National Forest	2,761	2	4,925	1,226
Eldorado National Forest	3,982	2,417	26,020	19,505
Humboldt-Toiyabe National Forest	1,727	0	3,438	726
Bioregional Total	**69,953**	**20,472**	**329,438**	**131,871**

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Timber Inventory

Timber inventory on the Sierra Nevada national forests is expected to continue to increase with time under both Alternatives S1 and S2. As measured without deduction for defect and other merchantability standards, current gross inventory is approximately 138 billion board feet (BBF). Predicted growth in the first decade is 17 BBF. The harvest projected in the first decade under Alternative S1 is 740 MMBF. This level of harvest would be about 4% of predicted growth. Under Alternative S2, however, harvest is projected to be 3,515 MMBF, which would be about 21% of predicted growth (see table 4.4.1c). These values represent trees ≥ 10 inches dbh, i.e. only sawtimber.

Figure 4.4.1c. Projected Harvest under Alternative S2 Compared to Current Inventory and Projected Growth in Decade 1.



(Source: USDA Forest Service, Pacific Southwest Region 2003i)

The volume harvested under either alternative would be negligible; the removal of 4-21% of growth in each decade—the percentage would vary by decade—would have little effect on the accumulation of volume in the bioregion. Harvest projected for Alternative S2 in the first decade would involve removal of about 2.5% of the current inventory. The percentage removed then declines to less than 1% in the following decades. Under both alternatives, timber inventory is projected to exceed 200 BBF by the beginning of the fourth decade (see figure 4.4.1a).

Table 4.4.1c. Timber Inventory, Growth, and Removal (MMBF).

	Decade				
	1	2	3	4	5
Alternative S1					
Inventory	138,283	154,693	174,082	191,316	206,552
Growth	17,150	19,599	17,650	15,494	14,359
Harvest	740	210	416	258	539
Alternative S2					
Inventory	138,077	151,941	170,939	189,398	206,538
Growth	17,378	20,400	18,941	17,518	16,937
Harvest	3,515	1,402	482	375	610

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Potential Commercial Biomass Supply

Table 4.4.1d shows projected commercial biomass that would be generated by Sierra Nevada national forests under Alternatives S1 and S2. This material would primarily be generated by mechanical treatments to reduce understory fuels. Alternative S2 would provide a somewhat greater opportunity for generating biomass, because it provides for a number of management objectives to be achieved within each treatment unit and imposes fewer restrictions on the use and intensity of mechanical treatments.

Under both alternatives, the Lassen and Plumas National Forests would be the greatest potential suppliers of the regional biomass market. As discussed in the FEIS (chapter 3, part 5.9, pages 524-527), several options exist for commercial use of this material. Facilities able to utilize this material, however, are limited in capacity. Forest-generated biomass supplies have been highly variable, which may be discouraging facility investment. Currently, the potential supply of raw material far exceeds regional market demand.

Table 4.4.1d. Potential Commercial Biomass Output by Decade (1,000s of bone-dry tons).

National Forest Unit	First Decade		Second Decade	
	Alternative S1	**Alternative S2**	**Alternative S1**	**Alternative S2**
Eldorado National Forest	256	555	366	880
Inyo National Forest	178	105	100	55
Lassen National Forest	1,032	1,961	608	1,123
Modoc National Forest, except BVFSYU	391	270	559	410
Big Valley Federal Sustained Yield Unit (BVFSYU)	0	0	0	0
Plumas National Forest	1,189	2,379	789	1,259
Sequoia National Forest	529	294	530	491
Sierra National Forest	175	316	450	502
Stanislaus National Forest	202	494	181	525
Tahoe National Forest	315	509	215	650
Lake Tahoe Basin Mangagement Unit	57	65	27	21
Humboldt-Toiyabe National Forest	61	73	25	33
Total	**4,385**	**7,021**	**3,850**	**5,948**

(Source: USDA Forest Service, Pacific Southwest Region 2003i)

Wood Products Employment and Income

The economic analysis in the FEIS provides the analytical basis for assessing the employment and earnings effects of Alternatives S1 and S2 (FEIS, volume 2, chapter 3, part 5.1, pages 387-395). In this analysis, employment and income supported by timber harvested from the Sierra Nevada national forests are directly linked to projections of sawtimber harvest by alternative. For purposes of this analysis, it is assumed that the basic economic structure of the region has not changed and that the basic economic structure of the region modeled relationships between harvest volumes and employment and earnings are still valid. However, if the recent decline in capacity of the wood products industry continues, fewer options will be available for economically-efficient harvest of sawtimber and biomass material.

The input-output model used to estimate economic effects in the FEIS is based on linear relationships, meaning that a direct relationship between input variables and model projections is assumed to hold. Once an array of outcomes have been developed, estimating effects of additional scenarios is relatively straightforward, without having to systematically repeat each step in the analysis process.

Total timber harvest and the distribution of harvest volumes across forests under Alternative S1 would be approximately the same as projected for Alternative 6 in the FEIS. Specifically, timber outputs under Alternative S1 would be 88% of those projected in the FEIS for Alternative 6. Similarly, timber output and distribution under Alternative S2 would be closest to those of Alternative 1 in the FEIS. Timber harvest under Alternative S2 would be 85% percent of that projected for Alternative 1.

Based on the ratios between timber harvest projections for Alternative S1 and S2 and the two FEIS alternatives described above, employment and earnings effects for the FEIS alternatives were adjusted to reflect the lower timber outputs of Alternatives S1 and S2 (Table 4.4.1e). Note that these estimates are for the first decade only. As documented in the above section on sawtimber production, harvest volumes would decline sharply in the second and third decades. Unless substitute timber volumes can be acquired from private lands or imported, a corresponding drop in wood product industry employment may result.

Table 4.4.1e. Projected Average Annual Employment and Earnings Generated by Forest Service Commercial Logging, Hauling, and Sawmilling in the Sierra Nevada Region (2004-2013).

	Alternative	
	S1	S2
Employment (direct, indirect, induced)	222	896
Earnings (thousands of 1995 dollars)	24,422	38,994

4.4.2. Grazing

The effects to grazing from Alternative S1 were assessed in very general terms for the FEIS (FEIS, Volume 2, Chapter 3, part 5.3, pp. 404-407). When that work was completed, information was lacking about the distribution of occupied habitat for species such as the Yosemite toad and certain standards and guidelines were dependent upon surveys yet to be completed (such as for the willow flycatcher). Much of the field survey work has since been done and this new information provides a better foundation from which to evaluate effects. The discussion below focuses on the environmental effects of Alternatives S1 and S2. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, part 4.3, pages 403-416.

Criteria Used to Categorize Effects

The effects reported here are based on professional judgment, given some basic information about allotment size and available forage, the number and location of critical habitat areas within the allotment, and other situational and operational factors. For allotments affected by the standards and guidelines, the following rationale was used to categorize the effects to the associated permittee as “low,” “medium,” or “high”:

Low impacts to grazing permittees - allotments include one or two habitat areas. Areas may be occupied or not depending on species (willow flycatcher unoccupied habitat assumes impact). Presence of habitat areas will require permittee to employ extra effort to avoid areas without affecting available forage for livestock.

Medium impacts to grazing permittee - allotments include two to four habitat areas. The amount of effort required by the permittee to avoid areas and/or maintain extra fence would create some hardship. The ability to continue to graze without affecting livestock numbers or season of use is achievable but may substantially increase overhead costs.

High impacts to grazing permittee - allotments include four or more habitat areas. The amount of effort required to avoid areas or maintain fencing would require substantial effort. Even with the substantial effort there may not be sufficient available forage to sustain permitted numbers and season of use.

Very high impacts to grazing permittee - even with substantial effort by the permittee the amount of available forage remaining may not be worth the value gained by grazing the allotment.

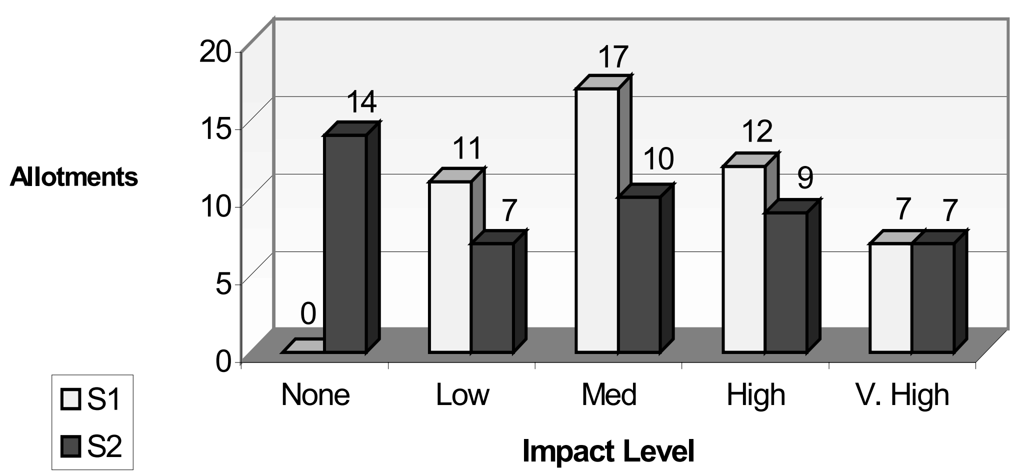
Assumptions

Following are some basic assumptions used to evaluate the effects of Alternative S2.

- About ten percent of the permittees will take advantage of the adaptive management strategy option provided under Alternative S2 for testing alternative utilization standards. The results afforded to those permittees will be limited unless the affected allotment has other impacts related to critical habitat areas. In those cases, there is assumed to be a 15 percent reduction in impacts to permittees.
- Fifty-six allotments with known unoccupied willow flycatcher sites (under Alternative S1) would no longer have a September 1st late-season grazing requirement. This would eliminate all grazing impacts from the willow flycatcher standards and guidelines for 18 allotments.
- Fifteen allotments with known occupied willow flycatcher sites (under Alternative S1) would have a late season meadow grazing opportunity after August 15th rather than total exclusion. This would lessen the impact to permittees for these allotments.
- For the three to four allotments most critically impacted by the existing standards and guidelines for willow flycatcher (Alternative S1), it is assumed that permittees would choose Alternative S2's option for developing and implementing a meadow management strategy.
- Of the 24 allotments impacted by the existing standards and guidelines for Yosemite toad (Alternative S1), it is assumed that permittees of the five most impacted allotments would develop site specific management plans (allowed under Alternative S2) to provide some flexibility in grazing around critical habitat. This is expected to provide slight reductions in impacts for these permittees.

Figure 4.4.2a shows the number of permittees affected by the alternatives and the relative degree of impact. The chart summarizes information from 47 allotments on seven of the 11 national forests within the bioregion. These are the allotments most affected by the standards and guidelines for willow flycatcher, Yosemite toad, and great gray owl habitat. They represent 11 percent of the active allotments within the Sierra Nevada Forest Plan area. Effects on the Modoc, Lake Tahoe Basin Management Unit, Eldorado, and Inyo National Forests were minor and are not reported here.

Figure 4.4.2a. Grazing Impacts Summary.



Alternative S1 was evaluated as having a low impact on 11 permittees, a medium impact on 17 permittees, and a high impact on 12 permittees. Fourteen of the allotments showing low, medium or high impacts under S1, would not be impacted under Alternative S2. Both alternatives are expected to cause a very high impact to 7 grazing permittees.

The differences in impacts between the alternatives are attributed mostly to willow flycatcher standards and guidelines for unoccupied sites. Under Alternative S2, permittees would be allowed to continue grazing in unoccupied willow flycatcher habitat. This difference between the alternatives affects 18 of 47 allotments.

Figure 4.4.2a also reflects differences in impacts to permittees with allotments containing occupied willow flycatcher habitat. Because Alternative S2 allows grazing in occupied willow flycatcher habitat after August 15, permittees can use the allotment for 4-6 weeks at the end of the season. Alternative S1 does not provide for this use.

Because there is little difference in the standard and guidelines for Yosemite toad habitat in Alternatives S1 and S2, little change between the impacts associated with those standards and guidelines is anticipated. It is unknown whether the option of developing site-specific management strategies for grazing on allotments with multiple occupied Yosemite toad habitat sites will reduce impacts to permittees. For this analysis, this option was assumed to reduce impacts slightly under Alternative S2. Because the habitat surveys for Yosemite toad are only two-thirds complete, there will likely be some increase in impacts to permittees under both alternatives, assuming more occupied habitat is discovered.

Great gray owl habitat appears on five of the 47 allotments analyzed. Two of the allotments also had willow flycatcher and/or Yosemite toad habitat and no change in impact was assumed under Alternative S2. A reduction in impacts was assumed to occur under Alternative S2 for the three allotments that included only great gray owl habitat.

4.4.3. Roads

The projected effects of roads in alternatives S1 and F2 – F8 are documented on pages 443 – 452 of the SNFPA FEIS (Vol. 2, Chapter 3). Road-related effects from these alternatives remain unchanged and are included by reference.

Table 4.4.3a. Projected Miles of Road Construction by Alternative (First Decade).

S1	S2	F2	F3	F4	F5	F6	F7	F8
25	115	5	21	129	12	20	100	8

Table 4.4.3b. Road Construction, Reconstruction, and Decommissioning in the First Decade.

	New Road Construction (miles)	Road Decommissioning (miles)	Net Difference in Classified and Unclassified Roads (miles)	% Change in Classified and Unclassified Roads*	Road Reconstruction (miles)
S1 (Total)	**25**	**950**	**-925**	**-3.1%**	**655**
S1 (Non-HFQLG Forests)	15	800	-785		460
S1 (HFQLG)	10	150	-140		195
S2 (Total)	**115**	**1175**	**-1060**	**-3.5%**	**1520**
S2 (Non-HFQLG Forests)	15	800	-785		460
S2 (HFQLG)	100	375	-275		1060

**based on an estimated 24,974 classified and 5,124 unclassified roads.*

Tables 4.4.3a and 4.4.3b display the projected miles of road construction by alternative. Alternative S2 is projected to construct more miles of road than S1, primarily due to almost 43,000 more acres of area thinning within the Sierra's and full implementation of the HFQLG pilot. The HFQLG FEIS projected about 20 miles of new system road construction per year during the 5-year period of implementation. However, during the last 3 years of implementation, the actual system road construction planned in projects averaged 5 miles per year. The lower construction rate is likely a consequence to implementing only 10% of the planned group selection as well as specific project design criteria.

From 2004 to 2009, the projection under S2 is that the full amount of group selection (8,700 acres per year) will be implemented; therefore, the projection is that HFQLG road construction in S2 would average about 20 miles of new system road construction annually during the 5-year life of the pilot program. The HFQLG forests are not likely to need any additional road construction if the full development under the Pilot Project has occurred. Thus, the average annual rate of system road construction within the HFQLG forests should average 10 miles per year in the first decade.

Compared to S1, Alternative S2 is projected to result in an additional 86 miles of road reconstruction, 43 miles of temporary road construction and 640 miles of road maintenance per year during the period of full HFQLG implementation. After 2009, the amounts are expected to decrease and be similar to what is expected in S1 (refer to the FEIS, pages 443 – 452).

Experience in recent years has shown that more miles of roads are decommissioned in project areas than are newly constructed. For all alternatives, the projection is that over time, the amount of system and non-system roads should decrease across the Sierras as a result of the decommissioning work. For example, from 2000 to 2003, the HFQLG pilot area proposed 122 miles of road decommissioning compared to 14 miles of new system construction. This results in a reduction of 108 miles of road on the landscape (an 89% reduction). This trend is expected across the Sierras for all alternatives.

By reducing the amount of roads on the landscape, the effects of fragmentation and disturbance to wildlife and associated habitats should decrease overtime. The potential for sedimentation effects to streams should also decrease, especially since many of the decommissioned roads are located next to streams. Further improvements in reducing the effects of roads should be realized through the reconstruction and maintenance of roads, which includes upgrading of drainage and drainage structures. This would reduce road-related impacts (soil erosion) to water quality.

4.4.4. Recreation

Standards and guidelines to address the five problem areas identified in the SNFPA FEIS placed some restrictions on recreation activities and infrastructure development in support of those activities. The section below describes the primary differences between Alternative S1 and S2 with regard to recreation. Under Alternative S2, standards and guidelines for sensitive species will have a limited effect on recreation activity, land use and development in the Sierra Nevada bioregion. In general, they allow the management direction for recreation activities to be developed at the local level. The environmental consequences for Alternatives F2-F8 are disclosed in the SNFPA FEIS in volume 2, chapter 3, pages 475-500.

Effects of Limited Operating Periods for Sensitive Species

Alternative S1 contains standards and guidelines that apply limited operating periods to all new activities in the vicinity of California spotted owl and northern goshawk nest sites and furbearer den sites. Some limited operating periods (LOPs) coincide with periods of peak recreation activity in the Sierra Nevada. In addition, the LOPs overlap with the construction season for winter sports operations, recreation resorts and campgrounds. Although there are no known effects on recreation activities at his time, there could be seasonal restrictions in the future.

Under Alternative S2, limited operating periods apply only to vegetation management activities and there would be no effect to recreation.

Effects of Standards and Guidelines for Willow flycatcher and Yosemite toad

Alternatives S1 and S2 include direction for managing livestock (including packstock) around suitable habitat for the willow flycatcher and Yosemite toad and require surveys of suitable habitat to be completed for these species.

Yosemite toad

Under Alternative S1, livestock (including pack and saddle stock) are to be excluded from wet areas occupied by Yosemite toad during the toad breeding and rearing season. If physical exclusion is impossible or impractical, livestock are to be excluded from the entire meadow. Under Alternative S2, this standard and guideline would not apply to pack and saddle stock.

The breeding and rearing season for Yosemite toads may extend into mid-summer, overlapping with a peak period of use for commercial packers in the high country of the Sierra Nevada. It is difficult to estimate the effects of Alternative S1 standards and guidelines for Yosemite toad on this type of recreational activity, because packstock grazing is more random and dispersed than grazing regulated through cattle and sheep allotments. Commercial packers have a number of meadows they can use for grazing and to some extent, can alter itineraries and shift use from one meadow to another if grazing restrictions are imposed. Ultimately, if large sections of key drainages become unavailable for grazing because of restrictions for Yosemite toad, packers will incur additional operating costs from packing feed. Because wilderness management plans limit the number of stock allowed per trip, packing feed may displace paying customers when large groups are being transported. Should this situation materialize, the economic impacts will vary by operator, depending upon the flexibility each packer has to respond to operational constraints.

Under Alternative S2, standards and guidelines for Yosemite toad do not apply to packstock or saddle stock grazing. As a practical matter, reliance on this option is likely to be limited because many meadows are a complex mosaic of dry, moist and wet portions that complicate any strategy to keep livestock out of wet portions.

Under Alternative S1, surveys of potentially suitable Yosemite toad habitat are to be completed by 2004. Areas not surveyed by this date, will be subject to the grazing restriction described above. Sixteen commercial pack stations operate during the summer in the high country of the Sierra Nevada. This standard and guideline may impact the grazing associated with packers operating on the Sierra National Forest. The forest has a substantial acreage of suitable toad habitat to survey and best estimates are that by 2004, roughly 3,200 acres in the wilderness will remain to be completed (USDA Forest Service, Pacific Southwest Region 2003g; pg. 70). As noted above, closures of entire watersheds may create an economic hardship for some packers. The magnitude of effect is difficult to determine because of the high degree of variability in the itineraries and operating efficiencies of individual businesses.

Alternative S2 would not impact recreation uses in suitable Yosemite toad habitat that has not been surveyed.

Willow flycatcher

Alternative S1 and S2 both contain direction for managing meadows occupied by willow flycatchers that may have some effect on commercial grazing operations. Under Alternative S1, when new detections of willow flycatcher occur, grazing is restricted until after August 31. Under Alternative S2, grazing is restricted until after August 15. In the event of new detections of willow flycatchers, the additional two-week grazing period allowed under Alternative S2 may allow use of some higher elevation meadows that otherwise would not have been available under Alternative S1.

4.5. Environmental Consequences for Alternatives F2 through F8

See chapter 2, section 2.5 for a discussion of Alternatives F2-F8 for specific key topics.

Alternative F2: Establish large reserves where management activities are very limited

With a management emphasis of protection and a low degree of active management and local flexibility, Alternative F2 treats annually (first decade) approximately 7,000 acres mechanically and 15,000 acres by prescribed burning, about 30 percent of the total effective acreage treated under Alternative S1 (approximately 51,000 acres of mechanical and 50,000 acres of prescribed burning). There is no strategic approach to fuel treatments; fuels treatments are conducted primarily to protect communities and reserves, relying mostly on suppression. The reduced use of prescribed burning from S1 would limit the possibility of escaped fires and air quality impacts. The limited amount of fuel treatments would result in the greatest number of acres burned annually at lethal levels by wildfire, a 10 percent increase in annual wildfire acres from the first to fifth decade (confidence is low that treatments would reduce wildfire extent and severity), and thus would not move fire regimes closer to their historic range and condition class 1.

Though Alternative F2 provides the largest amount (approximately 4,900,000 acres) in the short-term of old forest patches with high canopy closure (cover) in large reserves, a low degree of confidence exists that there would be no adverse effect on old forest habitats because wildfire losses are likely to increase and would offset this gain in old forest habitat. Low uncertainty associated with management effects on old forest function exists due to the limited amount of mechanical treatments.

The large amount of reserves; the low degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the inability to use timber sales and all silvicultural tools would result in lowered efficiencies and higher treatment costs.

Alternative F2 does not allow full implementation of the HFQLG Pilot Project. Alternative F2 would only allow 20 to 30 percent of this total, about 10,000 acres of DFPZs because of conflicts with the Biodiversity Reserves, and about 1,740 acres of GS because very few acres would be available based on the opening limit of less than 1 acre. About 57 mmbf would be produced per year.

Alternative F2 would have the lowest risk to aquatic species (fish and amphibians), primarily due to the amount of area protected by special aquatic areas, such as emphasis watersheds and critical refuges. It also would provide the greatest protection for riparian and meadow plant and animal communities because it limits activities adjacent to watercourses. Due to the low degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 273,000, a 17 percent reduction from Alternative S1, current management, which would produce about 330,000 AUMs (animal unit months).

Alternative F3: Actively manage to restore ecosystems. Use local analysis and collaboration

The management emphasis of protection and restoration, a moderate degree of active management, and a moderate to high degree of local flexibility for Alternative F3 would result in about 30,000 acres treated mechanically and about 54,000 acres treated by prescribed fire annually in the first decade, about 5,000 more acres than effectively treated in Alternative S1. The fuels strategy would be determined on a watershed rather than a larger landscape scale, and would increase the use of prescribed fire, emphasizing fuels reductions in areas of high fire hazard and risk, focused in urban wildland intermix zones. Uncertainties exist about the effectiveness of treatments in altering the fire regime (confidence is low). The use of prescribed fire is approximately the same as Alternative S1, including the attendant risk of escapement and socially unacceptable air quality impacts. The extent of fuels treatments would reduce the number of acres burned annually at lethal levels by wildfire, a 36 percent decrease in annual wildfire acres from the first to fifth decade, and thus would move fire regimes closer to their historic range and condition class 1.

A low to moderate degree of confidence exists that there would be no adverse effect on old forest habitats because of the possible losses to severe wildfire. Alternative F3 would have increases in old forest patches (about 1,300,000 acres of old forest emphasis areas) with high and moderate canopy closure (cover), with a low to moderate level of uncertainty associated with management effects on old forest function.

The protection of old forest emphasis areas, unroaded areas, and ecologically significant areas; the moderate degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the limited use of timber sales and all silvicultural tools would result in lowered efficiencies and higher treatment costs.

Alternative F3 does not allow full implementation of the Herger-Feinstein Quincy Library Group (HFQLG) pilot project. Alternative F3 would allow only 12,500 acres of DFPZs because of conflicts with the old forest emphasis areas and desired conditions across the landscape, and about 2,175 acres of GS because very few acres would be available based on the no timber harvest objective. About 72 mmbf would be produced per year.

Alternative F3 would have greater risk to aquatic species (fish and amphibians), mostly due to the possibility of more treatments in riparian areas. It would provide intermediate levels of protection for riparian and meadow plant and animal communities. Due to the moderate to high degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 344,000, a four percent increase from Alternative S1, which would produce about 330,000 AUMs (animal unit months).

Alternative F4: Develop ecosystems that are resilient to large-scale, severe disturbances

With a management emphasis of maintenance and resiliency and a high degree of active management and local flexibility, Alternative F4 would treat annually about 86,000 acres mechanically and about 47,000 acres by prescribed burning, about 146 percent of the total effective acres treated in Alternative S1, current management. Following landscape analysis, the fire and fuels treatment strategy emphasizes strategically placed area treatments and defensible fuel profile zones. The use of prescribed fire is nearly of the same as Alternative S1, with similar risk of escapement and socially unacceptable air quality impacts. The extensive amount of fuels treatment would reduce the number of acres burned annually at lethal levels by wildfire, a 39 percent decrease in wildfire acres from the first to fifth decade (confidence is high), and thus would move fire regimes closer to their historic range and condition class 1. Because treatments used to achieve management goals would be determined locally, the risk exists that the diversity of management actions employed would not lead to desired conditions.

Alternative F4 would maintain by watershed 20 percent in old forest patches (about 700,000 acres of old forest emphasis areas, less than half the amount of Alternative S1) with high and moderate canopy closure (cover) and the greatest certainty that more old forest patches could be protected from wildfire losses and, thus, the greatest likelihood of maintaining large, live trees with a net increase in large trees in both the short and long term. The amount and distribution would be determined at the project level. These moderately sized blocks would be widely distributed and more limited in providing continuity. A low degree of confidence exists that there would be no adverse effect on old forest habitats because of the concern that extensive reliance on mechanical treatment would damage resource values.

The low amount of reserves and emphasis on resiliency where a high degree of human management is used to create and maintain desired conditions and the high degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the ability to use timber sales and all silvicultural tools would result in higher efficiencies and lower treatment costs.

Alternative F4 would accomplish 95 to 100 percent of the HFQLG Pilot Project, about 45,000 acres of DFPZs and about 8,265 acres of GS because much of the area would be available for group selection. Approximately 271 mmbf would be produced per year.

Alternative F4 would have greater risk to aquatic species (fish and amphibians), mostly due to the possibility of more treatments in riparian areas. It would provide the lowest levels of protection for riparian and meadow plant and animal communities. Due to the high degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 357,000, an eight percent increase from Alternative S1, which would produce about 330,000 AUMs (animal unit months).

Alternative F5: Preserve existing undisturbed areas and restore others to achieve ecological goals. Limit impacts from active management through range-wide management standards and guidelines

Alternative F5’s management emphasis is protection and restoration, with a low to moderate degree of active management and a low degree of local flexibility. Annual mechanical and prescribed burning treatments would be about 10,000 acres and 39,000 acres, respectively, about 62 percent of the total effective acres treated in Alternative S1, current management. The priority of the fire and fuels treatment strategy is to reduce hazard in the urban wildland intermix zone; the treatment emphasis is prescribed fire with some mechanical treatment. The increased use of prescribed fire (about 80% the amount of acres of Alternative S1) would slightly reduce the risk of escapement and socially unacceptable air quality impacts. Annual wildfire acres from the first to fifth decade are projected to increase by 4 percent because of the lack of strategic placement of fuels treatments (confidence is low that treatments would reduce wildfire extent and intensity), and thus would not move fire regimes closer to their historic range and condition class 1. Confidence is low that there would be no adverse effect on old forest habitats because of the increased losses to wildfire.

Alternative F5 could provide a large increase in old forest patches (about 1,700,000 acres of old forest emphasis areas) with high and moderate canopy closure (cover) in the short term; however, because of restrictive or less effective fuel treatments these increases could be offset by increased future losses to severe wildfire. This alternative would have high likelihood of connectivity between large blocks dedicated to old forests, and low uncertainty associated with the potential effects of mechanical treatment on old forest function.

The amount of reserves and old forest emphasis areas where natural processes shape desired conditions; the low degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the low level of timber sales and silvicultural tools would result in lowered efficiencies and higher treatment costs.

Alternative F5 would not allow full implementation of the Herger-Feinstein Quincy Library Group (HFQLG) pilot project. Alternative F5 would accomplish only about 15,000 acres of DFPZs and about 2,610 acres of GS because of conflicts with old forest emphasis areas and fixed vegetative structure requirements across the landscape. About 86 mmbf would be produced per year.

Alternative F5 would have the lowest risk to aquatic species (fish and amphibians), primarily due to the amount of area protected by special aquatic areas, such as emphasis watersheds and critical refuges. It also would provide the greatest protection for riparian and meadow plant and animal communities because it limits activities adjacent to watercourses. Due to the low degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 241,000, a 27 percent reduction from Alternative S1, which would produce about 330,000 AUMs (animal unit months).

Alternative F6: Integrate desired conditions for old forest and hardwood ecosystems with fire and fuels management goals. Reintroduce fire into Sierra Nevada forest ecosystems

With a management emphasis of restoration, and a moderate degree of active management and local flexibility, Alternative F6 would treat annually about 33,000 acres mechanically and about 83,000 acres by prescribed burning, about 37,000 more acres than the total of effective acres treated in Alternative S1. The fire and fuels treatment strategy emphasizes strategically placed area treatments; landscape-scale structural requirements allow fuel treatments to be fully implemented. With approximately 33,000 more acres of prescribed burning than Alternative S1, there is a higher risk of escapement and socially unacceptable air quality and scenic conditions. The extensive amount of fuels treatment would reduce the number of acres burned annually at lethal levels by wildfire, a 33 percent decrease in wildfire acres from the first to fifth decade (confidence is high), and thus would move fire regimes closer to their historic range and condition class 1. However, there is the uncertainty and risk that focal ecosystems and species are at greater risk from fire and fuel treatments than they are from degradation by high severity wildfire.

A moderate to high degree of confidence exists that there would be no adverse effect on old forest habitats because of the extent of fuels treatment and by including emphasis areas to protect special resource values. Alternative F6 would have increases in old forest patches (about 1,600,000 acres of old forest emphasis areas) with high and moderate canopy closure (cover) and the greatest certainty that more old forest patches could be protected from wildfire losses and, thus, the greatest likelihood of maintaining large, live trees with a net increase in large trees in both the short and long term. There is a low to moderate uncertainty associated with the potential effects of mechanical treatment on old forest function.

The amount of old forest emphasis areas where prescribed fire is the preferred tool; the moderate degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the low level of timber sales and silvicultural tools would result in limited efficiencies and higher treatment costs.

Alternative F6 would not allow full implementation of the Herger-Feinstein Quincy Library Group (HFQLG) pilot project. Alternative F6 would allow for only about 30,000 acres of DFPZs because they could not be built where they overlap with old forest emphasis areas, and only about 5,220 acres of GS because of conflicts with old forest emphasis areas within Westside forest types, but would be compatible with general forest. About 172 mmbf would be produced per year.

Alternative F6 would have greater risk to aquatic species (fish and amphibians), mostly due to the possibility of more treatments in riparian areas. It would provide the greatest protection for riparian and meadow plant and animal communities because it limits activities adjacent to watercourses. Due to the moderate degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 341,000, a three percent increase from Alternative S1, existing management direction, which would produce about 330,000 AUMs (animal unit months).

Alternative F7: Actively manage entire landscapes to establish and maintain a mosaic of forest conditions approximating patterns expected under natural conditions

With a management emphasis of restoration and resiliency, and a moderate to high degree of active management and local flexibility, Alternative F7 would treat annually about 70,000 acres mechanically and about 60,000 acres by prescribed burning, about 51,000 more acres than effective acres treated in Alternative S1, current management. Using landscape analysis, the fire and fuels treatment strategy emphasizes high hazard and risk areas and generally strategically placed area treatments. The increased use of prescribed fire (about 10,000 more acres than Alternative S1) increases the risk of escapement and socially unacceptable air quality impacts. The extensive amount of fuels treatment would reduce the number of acres burned annually at lethal levels by wildfire, a 31 percent decrease in wildfire acres from the first to fifth decade (confidence is high), and thus would move fire regimes closer to their historic range and condition class 1. The greatest risk associated with this alternative is not achieving desired conditions across the landscape. A low degree of confidence exists that there would be no adverse effect on old forest habitats because of the concern that extensive reliance on mechanical treatment would damage resource values.

Alternative F7 does not allocate any old forest emphasis areas; rather, the amount and distribution of moderate-sized blocks dedicated to old forests would be determined at the project level. Thus, uncertainty exists about the development or maintenance of old forest patches. There would be a high loss of old forest to high severity fire because this alternative does not emphasize treatments in concentrations of old forests. There are high levels of uncertainty associated with the potential effects of mechanical treatment on old forest function.

The lack of formal reserves and with an emphasis on restoration and resiliency where a high degree of human management is used to create and maintain desired conditions; the high degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the ability to use timber sales and all silvicultural tools would result in higher efficiencies and lower treatment costs.

Alternative F7 would accomplish 95 to 100 percent of the HFQLG Pilot Project: about 45,000 acres of DFPZs in a full-built system because all acres are available, and about 8,265 acres of GS because much of the area would be available for group selection. About 271 mmbf would be produced per year.

Alternative F7 would have greater risk to aquatic species (fish and amphibians), mostly due to the possibility of more treatments in riparian areas. It would provide intermediate levels of protection for riparian and meadow plant and animal communities. Due to the moderate to high degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 357,000, an eight percent increase from Alternative S1, which would produce about 330,000 AUMs (animal unit months).

Alternative F8: Manage sensitive wildlife habitat cautiously. Develop new information to reduce uncertainty about the effects of management on sensitive species

The management emphasis of protection and restoration, a moderate degree of active management, and a low to moderate degree of local flexibility for Alternative F8 would result in about 14,000 acres treated mechanically and about 69,000 acres treated by prescribed fire annually in the first decade, about the same number of effective acres treated in Alternative S1. The fuels strategy is strategically placed area treatments, with limited use of mechanical treatments. Stand-level standards for retention of old forest structure may not allow fuels treatments to be fully implemented. The increased use of prescribed fire (about 20,000 more than Alternative S1) increases the risk of escapement and socially unacceptable air quality and scenic conditions. The extent of fuel treatments would reduce the number of acres burned annually at lethal levels by wildfire, a 6 percent decrease in annual wildfire acres from the first to fifth decade (confidence is moderate that treatments would reduce wildfire extent and intensity), and thus would not tend to move fire regimes much closer to their historic range and condition class 1. There is a higher short-term risk of high severity wildfire while waiting for the results of studies before implementing fuel reduction. A moderate to high degree of confidence exists that there would be no adverse effect on old forest habitats because of the inclusion of emphasis areas to protect special resource values.

Alternative F8 could provide a large increase in old forest patches (about 2,300,000 acres of old forest emphasis areas) with high and moderate canopy closure (cover) in the short term; these large blocks are dedicated to old forests, with their extent determined through analysis of habitat needs. However, because of restrictive or less effective fuel treatments, these increases could be offset by increased future losses to severe wildfire. The most restrictions on fuel treatments would apply in areas likely to contain concentrations of old forests, which would be subject to loss due to high severity wildfire. Levels of management in old forests are limited in the immediate future, and unclear in the longer term.

The amount of reserves and old forest emphasis areas where natural processes shape desired conditions; the low degree of flexibility to respond to changing local conditions, e.g., forest health problems such as pests, disease, and catastrophic fire events; and the low level of timber sales and silvicultural tools would result in lowered efficiencies and higher treatment costs.

Alternative 8 would not allow full implementation of the Herger-Feinstein Quincy Library Group (HFQLG) pilot project. Alternative F8 would allow only 12,500 acres of DFPZs because of the conflict with old forest emphasis system and the difficulty of avoiding areas with 70 percent crown closure, and only 2,175 acres of GS because it would not be allowed in old forest emphasis areas within Westside forest types, and could not occur in suitable owl habitat until the amount of suitable habitat was defined through research. About 72 mmbf would be produced.

Alternative F8 would have the lowest risk to aquatic species (fish and amphibians), primarily due to the amount of area protected by special aquatic areas, such as emphasis watersheds and critical refuges. It also would provide the greatest protection for riparian and meadow plant and animal communities because it limits activities adjacent to watercourses. Due to the low to moderate degree of local flexibility to address meadow-specific conditions when managing for livestock grazing, the resultant level of AUMs would be 303,000, an eight percent reduction from Alternative S1, which would produce about 330,000 AUMs (animal unit months).

4.6. Other Effects

Unavoidable Adverse Effects

Implementation of any of the alternatives would result in some unavoidable adverse effects. The alternatives were designed to move resources toward desired conditions but to accomplish those goals, some unavoidable adverse effects would result. These effects vary by resource and are discussed in others parts of this chapter.

Relationship between 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). 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 generation of Americans (NEPA, Section 101). Discussion related to short-term uses and long-term productivity can be found in detail in this chapter under individual resource discussions.

All alternatives would implement ground-disturbing activities that would produce short-term effects to soil, water quality and habitat while providing the long-term benefits in terms of prevention of and protection from wildfire and old forest conditions.

Irretrievable and Irreversible Commitment of Resources

Due to the programmatic nature of this Draft SEIS, the proposed action does not make any irretrievable or irreversible commitments of resources.

Civil Rights and Environmental Justice

No disparate or adverse effects are identified to groups of people identified in Civil Rights statutes or Executive Order 12898 (Environmental Justice) from the Proposed Action.

Appendix A: Standards and Guidelines Alternatives S1 and S2:

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Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
Amphibians			
X		Ensure that vegetative management activities including fuels reduction actions within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic/ riparian dependent species. The protection of human life and property must be considered as part of the Conservation Objectives.	Assess and document aquatic conditions following the Regional Stream Condition Inventory protocol prior to implementing ground disturbing activities within suitable habitat for California red-legged frog, Cascades frog, Yosemite toad, foothill and mountain yellow-legged frogs, and northern leopard frog.
	X	Ensure that vegetative management activities including fuels reduction actions within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic/ riparian dependent species. The protection of human life and property must be considered as part of the Conservation Objectives.	As appropriate, assess and document aquatic conditions following the Regional Stream Condition Inventory protocol prior to implementing ground disturbing activities within suitable habitat for California red-legged frog, Cascades frog, Yosemite toad, foothill and mountain yellow-legged frogs, and northern leopard frog.
X	Covered by existing law, regulation, or direction	Ensure that vegetative management activities including fuels reduction actions within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic/ riparian dependent species. The protection of human life and property must be considered as part of the Conservation Objectives.	In suitable habitat for California red-legged frog, Cascades frog, Yosemite toad, foothill and mountain yellow-legged frogs, and northern leopard frog, develop mitigation measures to avoid impacting these species whenever ground disturbing equipment is used within RCAs or CARs.
X	X		Limit application of pesticides in RCAs and CARs to cases where project-level analysis indicates their application is consistent with the Riparian Conservation Objectives. Avoid application of pesticides to areas within 500 feet of known occupied sites for California red-legged, foothill and mountain yellow-legged, Cascade and northern leopard frogs and Yosemite toads unless environmental analysis documents pesticides are needed to restore or enhance habitat for these amphibian species

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
Range			
X	X		Locate new livestock handling and management facilities outside meadows and RCAs. Prior to re-issuing grazing permits, assess the compatibility of livestock management facilities with the Riparian Conservation Objectives of the RCA.
X		To protect and allow for recovery of mountain and foothill yellow-legged frogs, California red-legged frog, and Yosemite toad populations in previously occupied habitat, and to protect habitats for other riparian dependant species.	Within RCAs and CARs prohibit application of pesticides to livestock.
Riparian Conservation Areas			
X	X	To maintain the ecological integrity of aquatic, riparian, and meadow ecosystems.	Determine which CARs or areas within CARs are suitable for mineral withdrawal and propose them for withdrawn from location and entry under the U.S. mining laws, subject to valid existing rights, for a term of 20 years. In CARs, approve mining-related plans of operation if measures are implemented that contribute toward the attainment or maintenance of aquatic management strategy goals.
X	X	Designation of riparian conservation area buffer widths	Designate riparian conservation area widths as listed in standards and guidelines below. RCA widths shown below may be adjusted at the project level if a landscape analysis has been completed and a site-specific RCO analysis demonstrates a need for different widths. Use a peer review process for vegetation treatments or other activities proposed within CARs and RCAs that are likely to significantly affect aquatic resources. Conduct peer reviews for projects that propose ground-disturbing activities in more than 25 percent of the RCA or more than 15 percent of a CAR.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X		Designation of default riparian conservation area buffer widths	**STREAM TYPE WIDTH OF THE RIPARIAN CONSERVATION AREA** ***Perennial Streams:*** 300 feet on each side of the stream, measured from the bank full edge of the stream ***Seasonally Flowing Streams*** *(includes ephemerals with defined stream channel or evidence of scour)**:*** 150 feet on each side of the stream, measured from the bank full edge of the stream ***Streams In Inner Gorge[1]:*** top of inner gorge ***Special Aquatic Features[2] or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank:*** 300 feet from edge of feature or riparian vegetation, whichever width is greater ***Other hydrological or topographic depressions without a defined channel.*** RCA width and protection measures determined through project level analysis [1]*Inner gorge is defined by stream adjacent slopes greater than 70 percent gradient* [2]*Special Aquatic Features include: lakes, meadows, bogs, fens, wetlands, vernal pools, and springs*
	X	Designation of default riparian conservation area buffer widths	**STREAM TYPE WIDTH OF THE RIPARIAN CONSERVATION AREA** ***Perennial Streams:*** 300 feet on each side of the stream, measured from the bank full edge of the stream ***Seasonally Flowing Streams*** *(includes intermittents and ephemerals)***:** 150 feet on each side of the stream, measured from the bank full edge of the stream ***Streams In Inner Gorge[1]*** **:** top of inner gorge ***Special Aquatic Features[2] or Perennial Streams with Riparian Conditions extending more than 150 feet from edge of streambank or Seasonally Flowing streams with riparian conditions extending more than 50 feet from edge of streambank:*** 300 feet from edge of feature or riparian vegetation, whichever width is greater ***Other hydrological or topographic depressions without a defined channel:*** RCA width and protection measures determined through project level analysis [1]*Inner gorge is defined by stream adjacent slopes greater than 70 percent gradient* [2]*Special Aquatic Features include: lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs*
X	Covered by existing law, regulation, or direction	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Implement project appropriate Best Management Practices and monitor their effectiveness following protocols outlined in “Investigating Water Quality in the Pacific Southwest Region: Best Management Practices Evaluation Program” (USDA-FS, PSW Region 1992).

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	X	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Evaluate new proposed management activities within CARs and RCAs during environmental analysis to determine consistency with the riparian conservation objectives at the project level and the AMS goals for the landscape. Ensure that appropriate mitigation measures are enacted to (1) minimize the risk of activity-related sediment entering aquatic systems, and (2) minimize impacts to habitat for aquatic- or riparian-dependent plant and animal species.
X	X	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Identify existing uses and activities in CARs and RCAs during landscape analysis. Evaluate existing management activities to determine consistency with RCOs during project-level analysis. Develop and implement actions needed for consistency with RCOs.
X	X	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Ensure management activities do not adversely affect water temperatures necessary for local aquatic- and riparian-dependent species assemblages.
X	Covered by other standards and guidelines	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Limit pesticide applications to cases where project level analysis indicates that pesticide applications are consistent with riparian conservation objectives.
X	X	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Prohibit storage of fuels and other toxic materials within RCAs and CARs except at designated administrative sites. Prohibit refueling within RCAs and CARs unless there are no other alternatives. Ensure that spill plans are reviewed and up-to-date.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Maintain and restore the hydrologic connectivity of streams, meadows, wetlands, and other special aquatic features by identifying roads and trails that intercept, divert, or disrupt natural surface and subsurface water flow paths. Implement corrective actions where necessary to restore connectivity.
X	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Ensure that culverts or other stream crossings do not create barriers to upstream or downstream passage for aquatic-dependent species. Locate water drafting sites to avoid adverse effects to in stream flows and depletion of pool habitat. Where possible, maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows, wetlands, and other special aquatic features.
X		Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Prior to activities that could affect streams, determine if relevant geomorphic characteristics, including bank angle, channel bank stability, bank full width-to-depth ratio, embeddedness, channel-floodplain connectivity, residual pool depth, or channel substrate are within the range of natural variability for the reference stream type as described in the Pacific Southwest Region Stream Condition Inventory protocol. If properties are outside the range of natural variability, implement restoration actions that will result in an upward trend.
	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Prior to activities that could adversely affect streams, determine if relevant stream characteristics are within the range of natural variability . If characteristics are outside the range of natural variability, implement mitigation measures and short-term restoration actions needed to prevent further declines or cause an upward trend in conditions. Evaluate required long-term restoration actions and implement them according to their status among other restoration needs.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Prevent disturbance to streambanks and natural lake and pond shorelines caused by resource activities (for example, livestock, off-highway vehicles, and dispersed recreation) from exceeding 20 percent of stream reach or 20 percent of natural lake and pond shorelines. Disturbance includes bank sloughing, chiseling, trampling, and other means of exposing bare soil or cutting plant roots. This standard does not apply to developed recreation sites and designated off-highway vehicle routes. In stream reaches occupied by the Lahonton, Little Kern Golden, and Paiute cutthroat trout, limit streambank disturbance from livestock to 10 percent of the occupied stream reach. Cooperate with State and Federal agencies to develop streambank disturbance standards for threatened, endangered, and sensitive species. Use the regional streambank assessment protocol. Implement corrective action where disturbance limits have been exceeded.
X		Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Determine if the age class, structural diversity, composition, and cover of riparian vegetation are within the range of natural variability for the vegetative community. If outside the range of natural variability, implement restoration actions that will result in an upward trend. Actions could include restoration of aspen or other riparian vegetation where conifer encroachment is identified as a problem.
	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	At either the landscape or project-scale, determine if the age class, structural diversity, composition, and cover of riparian vegetation are within the range of natural variability for the vegetative community. If conditions are outside the range of natural variability, consider implementing mitigation and/or restoration actions that will result in an upward trend. Actions could include restoration of aspen or other riparian vegetation where conifer encroachment is identified as a problem.
X		Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	For waters designated as “Water Quality Limited” (Clean Water Act Section 303(d)), implement appropriate State mandates for the water body, such as Total Maximum Daily Load (TMDL) protocols.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
	X	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	For waters designated as "Water Quality Limited" (Clean Water Act Section 303(d)), participate in the development of Total Maximum Daily Loads (TMDLs) and TMDL Implementation Plans. Execute applicable elements of completed TMDL Implementation Plans.
X		Ensure a renewable supply of large down logs that: (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to the RCA.	Determine if the level of coarse large woody debris (CWD) is within the range of natural conditions in terms of frequency and distribution and is sufficient to sustain stream channel physical complexity and stability. If CWD levels are deficient, ensure proposed management activities, when appropriate, contribute to the recruitment of CWD. Burning prescriptions should be designed to retain CWD; however short-term reductions below either the soil quality standards or standards in species management plans may result from prescribed burning within strategically placed treatment areas or the urban wildland intermix zone.
	X	Ensure a renewable supply of large down logs that: (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to the RCA.	Determine if the level of coarse large woody debris (CWD) is within the range of natural variability in terms of frequency and distribution and is sufficient to sustain stream channel physical complexity and stability. Ensure proposed management activities move conditions toward the range of natural variability.
X	Covered by another standard and guideline	Ensure a renewable supply of large down logs that: (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to the RCA.	In plantations within RCAs or CARs, determine if the plantation will be able to provide a sufficient supply of standing trees suitable for large wood recruitment. If there is not sufficient wood for recruitment, develop a restoration program that will provide standing trees of the appropriate size in the RCA or CAR. In developing the restoration program, ensure that proposed activities are consistent with the riparian conservation objectives.
X	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	Cooperate with Federal, Tribal, State and local governments to secure in stream flows needed to maintain, recover, and restore riparian resources, channel conditions, and aquatic habitat. Maintain in stream flows to protect aquatic systems to which species are uniquely adapted. Minimize the effects of stream diversions or other flow modifications from hydroelectric projects on threatened, endangered, and sensitive species.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	Covered by existing law, regulation, or direction	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	During relicensing of Federal Energy Regulatory Commission (FERC) hydroelectric projects, evaluate modifications by the project to the natural hydrograph. Determine and recommend in stream flow requirements and habitat conditions that maintain, enhance, or restore all life stages of native aquatic species, and that maintain or restore riparian resources, channel integrity, and fish passage. Provide written and timely license conditions to FERC. Coordinate relicensing projects with the appropriate State and Federal agencies.
X	X	Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	For exempt hydroelectric facilities on national forest lands, ensure that special use permit language provides adequate in stream flow requirements to maintain, restore, or recover favorable ecological conditions for local riparian- and aquatic-dependent species.
X		Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Within CARs, in occupied habitat or "essential habitat " as identified in conservation assessments for threatened, endangered, or sensitive species, evaluate the appropriate role, timing, and extent of prescribed fire. Avoid direct lighting within riparian vegetation; prescribed fires may back into riparian vegetation areas. Develop mitigation measures to <u>avoid</u> impacts to these species whenever ground disturbing equipment is used.
	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Within CARs, in occupied habitat or "essential habitat " as identified in conservation assessments for threatened, endangered, or sensitive species, evaluate the appropriate role, timing, and extent of prescribed fire. Avoid direct lighting within riparian vegetation; prescribed fires may back into riparian vegetation areas. Develop mitigation measures to <u>minimize</u> impacts to these species whenever ground disturbing equipment is used.
X	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Use screening devices for water drafting pumps. (Fire suppression activities are exempt during initial attack.) Use pumps with low entry velocity to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	Covered by existing law, regulation, or direction	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Conduct project-specific cumulative watershed effects analysis following Regional procedures or other appropriate scientific methodology to meet NEPA requirements.
X	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Design prescribed fire treatments to minimize disturbance of ground cover and riparian vegetation in RCAs. In burn plans for project areas that include, or are adjacent to RCAs, identify mitigation measures to minimize the spread of fire into riparian vegetation. In determining which mitigation measures to adopt, weigh the potential harm of mitigation measures, for example fire lines, against the risks and benefits of prescribed fire entering riparian vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could be damaging to habitat or long-term function of the riparian community.
X	Covered by other standards and guidelines	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Where catastrophic events, such as drought, fire, flooding, wind, or insect damage, result in degraded stand conditions, allow salvage harvesting and fuelwood cutting in RCAs and CARs consistent with the assessment of the RCOs for the area. Ensure that present and future woody debris needs are met.
X	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Post-wildfire management activities in RCAs and CARs should emphasize enhancing native vegetation cover, stabilizing channels by non-structural means, minimizing adverse effects from the existing road network, and carrying out activities identified by landscape analyses. Post-wildfire operations shall minimize the exposure of bare soil.
X		Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Allow mechanical ground disturbing fuels treatments, hazard tree removal, salvage harvest, or commercial fuelwood cutting within RCAs or CARs when the activity is consistent with RCOs. Projects providing for public health and safety, such as the felling of hazard trees or fuel reduction activities within the defense zone of the urban wildland intermix zones, are permitted. Utilize low ground pressure equipment, helicopters, over the snow logging, or other non-ground disturbing actions to operate off of existing roads when needed to achieve RCOs. Prior to removing trees within RCAs or CARs, determine if existing down wood is sufficient to sustain the stream channel physical complexity and stability required to maintain or enhance the aquatic- and riparian-dependent community. Ensure that existing roads, landings, and skid trails meet Best Management Practices. Minimize the construction of new skid trails or roads for access into RCAs for fuel treatments, salvage harvest, commercial fuelwood cutting, or hazard tree removal.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Allow hazard tree removal within RCAs or CARs. Allow mechanical ground disturbing fuels treatments, salvage harvest, or commercial fuelwood cutting within RCAs or CARs when the activity is consistent with RCOs. Utilize low ground pressure equipment, helicopters, over the snow logging, or other non-ground disturbing actions to operate off of existing roads when needed to achieve RCOs. Ensure that existing roads, landings, and skid trails meet Best Management Practices. Minimize the construction of new skid trails or roads for access into RCAs for fuel treatments, salvage harvest, commercial fuelwood cutting, or hazard tree removal.
X	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	During fire suppression activities, consider impacts to aquatic- and riparian-dependent resources. Where possible, locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of RCAs or CARs. During presuppression planning, determine guidelines for suppression activities, including avoidance of potential adverse effects to aquatic- and riparian-dependent species as a goal.
X		Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Assess roads, trails, OHV trails and staging areas, developed recreation sites, dispersed campgrounds, special use permits, grazing permits, and day use sites during landscape analysis. Identify conditions that degrade water quality or habitat for aquatic- and riparian-dependent species. At the project level, determine if use is consistent with other standards and guidelines or desired conditions. If inconsistent, modify the use through redesign, rehabilitation, relocation, closure, or re-directing the use to a more suitable location.
	X	Ensure management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	Identify roads, trails, OHV trails and staging areas, developed recreation sites, dispersed campgrounds, special use permits, grazing permits, and day use sites during landscape analysis. Identify conditions that degrade water quality or habitat for aquatic and riparian-dependent species. At the project level, implement actions to ensure consistency with other standards and guidelines or desired conditions.
X	X	Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas.	Assess the hydrologic function of meadow habitats and other special aquatic features during range management analysis. Ensure that characteristics of special features are, at a minimum, at Proper Functioning Condition, as defined in the appropriate Technical Reports (or their successor publications): (1) “Process for Assessing PFC” TR 1737-9 (1993), “PFC for Lotic Areas” USDI TR 1737-15 (1998) or (2) “PFC for Lentic Riparian-Wetland Areas” USDI TR 1737-11 (1994).
X		Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Implement soil quality standards for ground cover, compaction, soil displacement, and ground disturbance to minimize the risk of sediment delivery to aquatic systems from management activities. Ensure that management-related activities, including roads, skid trails, landings, trails, or other activities, do not result in detrimental soil compaction on more than 5 percent of the RCA or 10 percent of the area in CARs. Measure compaction using the procedures outlined in Appendix F of the FEIS.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	X	Identify and implement restoration actions to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species.	Recommend restoration practices for: (1) areas with compaction in excess of soil quality standards, (2) areas with lowered water tables, or (3) areas that are either actively down cutting or that have historic gullies. Identify other management practices, for example, road building, recreational use, grazing, and timber harvests, that may be contributing to the observed degradation.
X		Maintain or enhance the abundance, distribution, condition and ecological process needed to sustain species of special aquatic features such as meadows, lakes, ponds, bogs, fens, and wetlands.	Exclude livestock (including pack and saddle stock) from standing water and saturated soils in wet meadows and associated streams and springs occupied by Yosemite toads or identified as "essential habitat" in the conservation assessment for the Yosemite toad during the breeding and rearing season (as determined locally). If physical exclusion of livestock, such as fencing, is impractical, then exclude grazing from the entire meadow until the meadow has been dry for two weeks. Wet meadows are defined as relatively open meadows with moderate to low amounts of woody vegetation that have standing water on June 1st or for more than two weeks following snow melt. Determine if the meadow has standing water and saturated soils after June 1, if the meadows do not have these conditions for more than two weeks, grazing may be allowed only in those portions of the meadow where those conditions do not exist. Within the historic range of the species, surveys of unoccupied suitable habitat to determine presence of Yosemite toads must be completed within 3 years of this Record of Decision. If surveys are not completed for any meadow, occupancy will be assumed and the above restrictions apply.
X		Maintain or enhance the abundance, distribution, condition and ecological process needed to sustain species of special aquatic features such as meadows, lakes, ponds, bogs, fens, and wetlands.	Monitor a sample of occupied Yosemite toad sites on a periodic basis to assess habitat condition and Yosemite toad occupancy and population dynamics. Based upon monitoring data, modify or suspend grazing it Yosemite toad conservation is not being accomplished. These grazing restrictions may also be modified to assess the effects of grazing intensity and frequency and habitat conditions on Yosemite toad site occupancy as a formal adaptive management study developed in cooperation with the PSW Research Station

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
	X	Maintain or enhance the abundance, distribution, condition and ecological process needed to sustain species of special aquatic features such as meadows, lakes, ponds, bogs, fens, and wetlands.	Exclude livestock from standing water and saturated soils in wet meadows and associated streams and springs occupied by Yosemite toads or identified as "essential habitat" in the conservation assessment for the Yosemite toad during the breeding and rearing season (through metamorphosis). Specific dates will be determined locally. If physical exclusion of livestock is impractical, then exclude grazing from the entire meadow. Livestock does not include pack and saddle stock. Exclusions may be waived if an interdisciplinary team has developed a site-specific management plan to minimize impacts to the Yosemite toad and its habitat by managing the movement of stock around wet areas. Such plans are to include a requirement for systematically monitoring on an annual basis a sample of occupied Yosemite toad sites within the meadow to: (1) assess habitat conditions and (2) assess Yosemite toad occupancy and population dynamics. Every 3 years from the date of the plan, evaluate monitoring data and modify or suspend grazing if Yosemite toad conservation is not being accomplished. Plans must be approved by the authorized officer and incorporated into all allotment plans and/or special use permits governing use within the occupied habitat. Wet meadow habitat for Yosemite toads is defined as relatively open meadows with low to moderate amounts of woody vegetation that have standing water on June 1 or for more than 2 weeks following snow melt. Conduct surveys of unoccupied suitable habitat for the Yosemite toad within this species' historic range to determine presence of Yosemite toads. Complete surveys of these areas within 2 years of the Record of Decision.
X		Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas.	Locate new facilities for gathering livestock and pack stock outside of meadows and riparian areas. During landscape analysis, evaluate and consider relocating existing livestock facilities outside of meadows and riparian areas. Prior to re-issuing grazing permits, assess the compatibility of livestock management facilities located in RCAs with riparian conservation objectives.
	X	Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas.	Locate new facilities for gathering livestock and pack stock outside of meadows and riparian areas. During project-level planning, evaluate and consider relocating existing livestock facilities outside of meadows and riparian areas. Prior to re-issuing grazing permits, assess the compatibility of livestock management facilities located in RCAs with riparian conservation objectives.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X	Covered by other standards and guidelines	Identify and implement restoration actions to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species.	Reclaim abandoned mine sites that are degrading aquatic riparian and meadow ecosystems. First priority is to reclaim sites with hazardous or toxic substances located within CARs and RCAs.
X	Covered by other standards and guidelines	Ensure identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	Identify existing and potential sources of sediment delivery to aquatic systems. Implement preventive and restoration measures, such as modifying management activities, increasing ground cover, reducing the extent of compacted surfaces, or revegetating disturbed sites to reduce or eliminate sediment delivery from these sources to aquatic systems.
Roads			
X	X	Watershed protection	To provide protection for watershed resources, the following standards should be met for new road construction reconstruction and relocation: (1) design new stream crossings and replacement stream crossings for at least the 100 year flood, including bedload and debris; (2) design stream crossings to minimize the diversion of streamflow out of the channel and down the road in the event of crossing failure; (3) design stream crossings to minimize disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface water; (4) avoid wetlands or minimize effects to natural flow patterns in wetlands; and (5) avoid road construction in meadows.
Willow Flycatcher			
X		Restore degraded meadow habitats so they are able to support willow flycatcher populations.	As part of landscape analysis, give priority to meadow restoration opportunities near or adjacent to willow flycatcher sites.
X	Covered by other standards and guidelines	Minimize Roads in willow flycatcher habitat.	To the extent possible, construct no new roads in potential willow flycatcher habitat (occupied willow flycatcher habitat, known willow flycatcher sites, emphasis habitat, and small, wet woody meadows).
X		Survey known willow flycatcher sites to determine occupancy.	Initiate a 4-year cycle for willow flycatcher surveys in **known willow flycatcher sites**. Conduct surveys to established protocols in all known sites the first year. The second year surveys will occur in those 82 known sites where willow flycatchers were not found. Surveys will not occur the third and fourth year. The survey cycle will then be repeated.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
	X	Survey known willow flycatcher sites to determine occupancy.	**For occupied and historically occupied sites:** Initiate a 4-year cycle for willow flycatcher surveys. Conduct surveys to established protocols in all sites the first year. The second year surveys will occur in those sites where willow flycatchers were not found. Surveys will not occur the third and fourth year. The survey cycle will then be repeated. **For conditionally occupied sites:** Survey will occur in the first year. If willow flycatchers are found, these sites will be managed as occupied sites. If not found, these sites will be dropped from the survey cycle.
X		Protect known willow flycatcher sites.	If willow flycatcher(s) are detected through the above survey efforts, eliminate livestock grazing in the entire meadow (to the forested or other upland vegetation edge) beginning one calendar year after detection. Use permanent or electrical fencing or otherwise ensure livestock avoid these sites. If willow flycatcher(s) are not detected, then late season grazing may occur at utilization levels assessed according to habitat condition. Beginning in 2003, livestock will not be allowed to graze in meadows where willow flycatcher surveys have not been completed.
	X	Protect occupied willow flycatcher sites.	In meadows with occupied willow flycatcher sites, only allow late-season grazing (after August 15) in the entire meadow. This requirement may be waived if an interdisciplinary team has developed a site-specific meadow management strategy. This strategy is to be developed and implemented in partnership with the affected grazing permittee. The strategy objectives must focus on protecting the nest site and associated habitat during the breeding season and the long-term sustainability of suitable habitat at breeding sites. It may use a mix of management tools, including grazing systems, structural improvements, and other exclusion by management techniques to protect willow flycatcher habitat.
	X	Restore degraded habitat in meadows with unoccupied willow flycatcher sites	For historically occupied willow flycatcher sites, assess willow flycatcher habitat suitability within the meadow. If habitat is degraded, develop restoration objectives and take appropriate actions (such as physical restoration of hydrological components, limiting or re-directing grazing activity, etc.) to move the meadow toward desired conditions.
X	X	Monitor willow flycatcher sites receiving late season grazing	In willow flycatcher sites receiving late-season grazing, monitor utilization annually using regional range analysis and planning guide. Monitor willow flycatcher habitat every 3 years using the following criteria: rooting depth cores for meadow condition, point intercepts for shrub foliar density, and strip transects for shrub recruitment and cover. Meadow condition assessments will be included in a GIS meadow coverage. If habitat conditions are not supporting the willow flycatcher or trend downward, modify or suspend grazing.
X		Protect known and occupied willow flycatcher sites receiving late season grazing	Grazing will not occur in known and occupied willow flycatcher sites during the willow flycatcher breeding season, which extends from June 1 to August 31, unless multi-year monitoring data support different dates for a particular breeding location.

Aquatic/Riparian

S1	S2	Objective	Standard & Guideline
X		Survey potential willow flycatcher sites to determine occupancy and manage accordingly.	Within 3 years, survey emphasis habitat in active grazing allotments within five miles of the 82 known sites to determine willow flycatcher occupancy using established protocols. Emphasis habitat is defined as meadows greater than 15 acres in size with standing water on June 1 and a deciduous shrub component. (A) If willow flycatchers are detected, late season grazing will be implemented at utilization levels assessed according to habitat condition. Subsequent willow flycatcher surveys will follow the protocols for known willow flycatcher sites. Surveys will be conducted of emphasis habitat within 5 miles of these sites. (B) If no detections are made, the season-long grazing standard and guideline applies. Surveys will be repeated every three years. (C) If willow flycatcher surveys are not completed within 3 years, late season grazing will be implemented.
	X	Survey potential willow flycatcher sites to determine occupancy and manage accordingly.	As part of the project planning process, survey emphasis habitat within 5 miles of occupied willow flycatcher sites to determine willow flycatcher occupancy. Use established protocols to conduct these surveys. If these surveys determine willow flycatcher occupancy, add these to the database of occupied willow flycatcher sites and include them in the 4-year survey cycle of willow flycatcher sites described above.
X		Protect known willow flycatcher sites or survey them to determine occupancy and manage accordingly.	Evaluate site condition of known sites and emphasis habitat. Those sites that no longer contain standing water on June 1 and a deciduous shrub component may be removed from the conservation network.
	X	Protect known willow flycatcher sites or survey them to determine occupancy and manage accordingly.	Evaluate site condition of historically occupied willow flycatcher sites. Those sites that no longer contain standing water on June 1 and a deciduous shrub component and cannot be reasonably restored, may be removed from the conservation network.
X	Covered by existing law, regulation, or direction	Study grazing effects in known and occupied willow flycatcher sites and manage according to experimental protocol	The willow flycatcher grazing standards may be modified to assess the effects of grazing intensity and frequency on willow flycatcher site occupancy or demography, as a formal management study developed in cooperation with the Pacific Southwest Research Station.

Home Range Core Area

S1	S2	Objective	Standard & Guideline
California Spotted Owl			
X	X	Designation of spotted owl home range core areas	Establish a home range core area surrounding each territorial spotted owl activity center detected after 1986. The core area amounts to 20% of the area described by adding one standard error to the mean breeding pair home range. The core area size is: 2400 acres on the Hat Creek and Eagle Lake Ranger Districts of the Lassen National Forest; 1000 acres on the Almanor Ranger District of the Lassen National Forest, Modoc, Inyo, Humbolt-Toiyabe, Plumas, Tahoe, Eldorado and Stanislaus National Forests; and 600 acres on the Sequoia and Sierra National Forests.
X		Designation of spotted owl home range core areas	The core area is delineated based upon aerial photography. Acreage for the entire core area must be identified on National Forest lands and be designed to encompass the best available spotted owl habitat in the closest proximity to the owl activity center (including the 300-acre PAC). The best available habitat should be selected to incorporate (where available): (1) two or more tree canopy layers; (2) trees in the dominant and codominant crown classes averaging at least 24 inches dbh, and (3) in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and other stands with at least 50% tree canopy cover (including hardwoods). Core areas should be delineated within 1.5 miles of the activity center.
	X	Designation of spotted owl home range core areas	The core area is delineated based upon aerial photography. Acreage for the entire core area must be identified on National Forest lands and be designed to encompass the best available spotted owl habitat in the closest proximity to the owl activity center (including the 300- acre PAC). Select the best available contiguous habitat blocks to incorporate (where available), in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and other stands with at least 50% tree canopy cover (including hardwoods). Core areas should be delineated within 1.5 miles of the activity center.
X	X	Designation of spotted owl home range core areas	For Forest Service activities planned adjacent to non-Forest Service lands, delineate a circular core area around activity centers identified on non-Forest Service lands. Designate any portion of the circular area occurring on National Forest System lands as a core area and identify the best available habitat as described above.
X		Fuel Treatments in Defense Zone of the Urban Wildland Intermix for Forested stands other than plantations	Design mechanical fuels treatments to remove the material necessary to achieve the following outcomes: Stands with <40% canopy cover: over 90 percent of the stand area, achieve an average height to live crown of 15 feet and an average flame length of four feet or less if the stand were to burn under 90th percentile fire weather conditions; Stands with 40 to 70% canopy cover: over 90 percent of the stand area, achieve an average height to live crown of 20 feet and an average flame length of four feet or less if the stand were to burn under 90th percentile fire weather conditions. Stands with >70% canopy cover: over 90 percent of the stand area, achieve an average height to live crown of 25 feet and an average flame length of four feet or less if the stand were to burn under 90th percentile fire weather conditions. Do not mechanically treat the remaining 10% of the stand area to enhance stand heterogeneity.

Home Range Core Area

S1	S2	Objective	Standard & Guideline
California Spotted Owl			
X		Fuel Treatments in Defense Zone of the Urban Wildland Intermix for Forested stands other than plantations:	Achieve the above outcomes by thinning from below to remove surface and ladder fuels.
X		Fuel Treatments in PACs in the Defense Zone of the Urban Wildland Intermix	Mechanical treatments are prohibited within a 500-foot radius buffer around a spotted owl activity center within the designated PAC. Allow prescribed burning within the 500-foot radius buffer. Prior to burning conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), within a 1- to 2-acre area surrounding known nest trees as needed to protect nest trees and trees in their immediate vicinity. The remainder of the PAC may be mechanically treated to achieve the fuels reduction outcomes for General Forest outside Core Areas.
	X	Fuel Treatments in PACs in the Defense and Threat Zones of the Urban Wildland Intermix	Mechanical treatments are prohibited within a 500-foot radius buffer around a spotted owl activity center within the designated PAC. Allow prescribed burning within the 500-foot radius buffer. Prior to burning conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), as needed to protect important elements of owl habitat. The remainder of the PAC may be mechanically treated using the forest-wide standards and guidelines for mechanical thinnings.

Forest Wide

S1	S2	Objective	Standard & Guideline
Air Quality			
X	Covered by existing law, regulation, or direction	Coordination and cooperation on air quality management.	Coordinate and cooperate on air quality management. Conduct prescribed burns when favorable smoke dispersal is forecast, especially away from sensitive or Class 1 areas. Use appropriate smoke modeling software to predict smoke dispersion. Minimize smoke emission by following Best Available Control Measures (BACMs). Avoid burning on high visitor days and notify public before burning. Comply with Title 17 and interim air quality policy, and local smoke management programs Memorandum of Understanding with CARB and Nevada Smoke Management Plan.
Snags, Down Wood, Post-Fire Restoration, Salvage			
X		Provide sufficient amounts of down woody material large clumps of snags, and legacy elements important to future old forests and biodiversity when conducting fuel treatment projects.	Within westside vegetation types, beginning with the largest down logs, sequentially retain pieces of down wood until an average of at least 10 to 20 tons per acre are retained over a treatment unit. Within eastside vegetation types retain at least 3 large down logs per acre. Do not retain pieces smaller than 12 inches in diameter at midpoint to meet this standard. Exempted in the Defense Zone of the Urban Wildland Intermix.
	X	Provide sufficient amounts of down woody material large clumps of snags, and legacy elements important to future old forests and biodiversity when conducting fuels and vegetation treatment projects.	Determine down woody material retention levels on an individual project basis, based on desired future condition. Emphasize retention of wood in the largest size classes and in decay classes 1,2, and 3. Consider the effects of follow-up prescribed fire in achieving desired down wood retention levels.
X	Covered by other standards and guidelines	Provide sufficient amounts of down woody material large clumps of snags, and legacy elements important to future old forests and biodiversity.	As special use permits for areas larger than 40 acres are issued or re-issued, consider site-specific measures to maintain coarse woody material. Permits for areas less than 40 acres are exempt from this standard and guideline.

Forest Wide

S1	S2	Objective	Standard & Guideline
X		Provide sufficient amounts of down woody material large clumps of snags, and legacy elements important to future old forests and biodiversity.	Following stand replacing events (wildfire, insects, and disease), conduct no salvage harvest within at least 10 percent or greater of the total area affected by the stand-replacing event. Retain stands in the unsalvaged acreage with California Wildlife Habitat Relationship size classes 6 or 5 (average dbh of overstory trees (snags) greater than 24 inches), Where 5 and 6 size class stands comprise less than 10 percent of the stand replacement area, retain additional acreage in stands that are size class 4 (average dbh of overstory trees (snags) 11 to 24 inches). This standard and guideline does not apply to the Defense Zone of the Urban Wildland Intermix.
	X	Design and undertake projects to manage long-term fuel profiles, restore habitat, and recover commercial value of some of the fire-killed timber following large wildland fires	Determine the need for ecosystem restoration projects following large, catastrophic disturbance events (wildfire, drought, insect and disease infestation, windstorm, and other unforeseen events). Objectives for restoration projects may include limiting fuel loads over the long term, restoring habitat, and recovering economic value from dead and dying trees. In accomplishing restoration goals, long-term objectives are balanced with the objective of reducing hazardous fuel loads in the short-term. Salvage harvest of dead and dying trees may be conducted to recover the economic value of this material and to support objectives for reducing hazardous fuels, improving forest health, re-introducing fire, and/or speeding recovery of old forest conditions. Design projects to reduce potential soil erosion and the loss of soil productivity caused by loss of vegetation and ground cover. Examples are activities that would: (1) provide for adequate soil cover in the short term; (2) accelerate the dispersal of coarse woody debris; (3) reduce the potential impacts of the fire on water quality; and (4) carefully plan restoration/salvage activities to minimize additional short-term effects. Design projects to protect and maintain critical wildlife habitat. Examples are activities that would: (1) avoid areas where forest vegetation is still largely intact; (2) provide for sufficient quantities of large snags; (3) maintain existing large woody material as needed; (4) provide for additional large woody material and ground cover as needed; (5) accelerate development of mature forest habitat through reforestation and other cultural means; and (6) provide for a mix of seral stages over time. Design projects to manage the development of fuel profiles over time. Examples are activities that would: (1) remove sufficient standing and activity generated material to balance short-term and long-term surface fuel loading; and (2) protect remnant old forest structure (surviving large trees, snags, and large logs) from high severity re-burns or other severe disturbance events in the future. Design projects to recover the value of timber killed or severely injured by the disturbance. Examples are activities that would: (1) conduct timber salvage harvest in a timely manner to minimize value loss; (2) minimize harvest costs within site-specific resource constraints; and (3) remove material that local managers determine is not needed for long-term resource recovery needs.

Forest Wide

S1	S2	Objective	Standard & Guideline
	X	Design and undertake projects to manage long-term fuel profiles, restore habitat, and recover commercial value of some of the fire-killed timber following large wildland fires	In post fire restoration projects for large catastrophic fires (contiguous blocks of moderate to high fire lethality of 1,000 acres or more), generally do not conduct salvage harvest in at least 10 percent of the total area affected by fire.
	X	Remove and utilize dead and dying trees to recover value and support vegetation management objectives	Use the best available information on determining tree mortality for the purpose of salvage as developed by the Pacific Southwest Region Forest Health Protection Staff.
	X	Retain key habitat elements for old forest associated species	Outside of the defense zone of the wildland urban intermix zone, salvage harvests are prohibited in protected activity centers and known den sites unless a biological evaluation determines proposed harvest areas are rendered unsuitable for the purpose they were intended by a catastrophic stand-replacing event.
X		Provide sufficient amounts of down woody material large clumps of snags, and legacy elements important to future old forests and biodiversity.	Retain the following numbers of large snags after fuels treatments except where: (1) snag removal is needed to address imminent safety hazards and (2) snag levels are reduced as a result of incidental loss to prescribed fire. Retain 4 of the largest snags per acre on westside in mixed conifer and ponderosa pine, 6 per acre in red fir, and 3 per acre in eastside pine and mixed conifer, except in Defense Zone of the urban wildland intermix and within developed recreation sites. Evaluate snag density on a 40-acre basis.
X		Maintain and enhance critical wildlife habitat elements.	Where hardwood snags exist, retain 4 of the largest per acre, averaged over 10 acres. Where standing live trees lack dead branches, supplement wildlife need for dead material by retaining 6 of the largest snags per acre, where they exist.

Forest Wide

S1	S2	Objective	Standard & Guideline
	X	Provide sufficient amounts of down woody material large clumps of snags, and legacy elements important to future old forests and biodiversity.	Snag retention levels shall be determined on an individual project basis for vegetation treatments. Design projects to implement and sustain a generally continuous supply of snags and live decadent trees suitable for cavity nesting wildlife across a landscape. Retain some mid and large diameter live trees that are currently in decline, have substantial wood defect, or that have desirable characteristics (teakettle branches, large diameter broken top, large cavities in the bole) to serve as future replacement snags and to provide nesting structure. When determining snag retention levels, consider land allocation, desired condition, landscape position, and site conditions (such as riparian areas and ridge tops), avoiding uniformity across large areas. General guidelines for large-snag retention are as follows: ▪ In westside mixed conifer and ponderosa pine types, four of the largest snags per acre should be retained. ▪ In the red fir forest type, six of the largest snags per acre should be retained. ▪ In eastside pine and eastside mixed conifer forest types, three of the largest snags per acre should be retained. ▪ In westside hardwood ecosystems, four of the largest snags (hardwood or conifer) per acre should be retained. ▪ Where standing live hardwood trees lack dead branches, six of the largest snags per acre should be retained, where they exist, to supplement wildlife needs for dead material. ▪ Use snags larger than 15 inches dbh to meet this guideline. Snags should be clumped and distributed irregularly across the treatment units. Consider leaving fewer snags strategically located in treatment areas within the wildland urban intermix zone. While some snags will be lost due to hazard removal, or the effects of prescribed fire, consider these potential losses during project planning to achieve desired snag retention levels.
Range			
X	X	Protect hardwood regeneration in grazing allotments	To protect hardwood regeneration in grazing allotments, allow livestock browse on no more than 20 percent of hardwood annual growth of seedlings and advanced regeneration. Alter utilization if hardwood ecosystem goals are not being met.
X	X	Protect hardwood regeneration in grazing allotments	In annual grasslands, grazing utilization will maintain a minimum of 60 percent cover. Where in satisfactory condition, manage for 700 pounds per acre residual dry matter (RDM) where annual precipitation is greater than 10 inches, and 400 pounds per acre where less than 10 inches. Where in unsatisfactory conditions, manage for 1000 pounds per acre RDM where precipitation is greater than 10 inches, and 700 pounds per acre where less than 10 inches. -- Lower grazing utilization if ecosystem goals are not being met. This standard and guideline only applies to grazing utilization.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	X	Maintain suitable habitat for meadow-associated species by using appropriate grazing utilization standards.	Under season-long grazing, livestock utilization of grass and grass-like plants are limited to 30 percent (or minimum 6 inch stubble height) for meadows in early seral status and to a maximum of 40 percent (or minimum 4 inch stubble height) for meadows in late seral status. Ecological status on all key areas monitored for grazing utilization is to be determined prior to establishing utilization levels. Under intensive grazing systems (e.g., rest-rotation, deferred rotation) where meadows are receiving a period of rest, utilization levels can be higher if meadow is maintained in late seral status and meadow-associated sensitive species are not being impacted. Degraded meadows (e.g. early seral, with greater than 10 percent bare soil and active erosion) require total rest from grazing until they have recovered and have moved to mid or late seral status. Determination of ecological status is according to Regional ecological scorecards and range plant list. Every three to five years analyze meadow ecological status, if determined to be in a downward trend, modify or suspend grazing. Available range trend data and annual monitoring data for key areas within allotments will be included in a spatially explicit Geographic Information System (GIS) meadow coverage.
	X	Maintain suitable habitat for meadow-associated species by using appropriate grazing utilization standards.	Where professional judgment and quantifiable measurements find that current practices are maintaining range in good to excellent condition, the grazing utilization standards above may be modified to allow for the Forest Service, in partnership with selected permittees, to rigorously test and evaluate alternative standards.
X	Covered by existing law, regulation, or direction	Study grazing effects in known and occupied willow flycatcher sites and manage according to experimental protocol	Grazing standards specified above may be modified to assess the effects of grazing intensity and frequency on willow flycatcher site occupancy or demography, as a formal management study developed in cooperation with PSW.
X		Maintain and restore woody riparian vegetation in meadows and riparian areas, where they naturally occur (some meadows naturally lack woody vegetation). Ensure willow and aspen seedlings are able to be recruited into tree or shrub form	Browsing will not exceed 20 percent of the annual leader growth of mature riparian shrubs (e.g. willows and aspen) No more than 20 percent of the individual seedlings can be browsed. Remove livestock from any area of the allotment when browsing indicates a change in livestock preference from grazing herbaceous vegetation to browsing woody riparian vegetation. Herd sheep away from these plants at all times.

Forest Wide

S1	S2	Objective	Standard & Guideline
	X	Maintain and restore woody riparian vegetation in meadows and riparian areas, where they naturally occur (some meadows naturally lack woody vegetation). Ensure willow and aspen seedlings are able to be recruited into tree or shrub form	Browsing will not exceed 20 percent of the annual leader growth of mature riparian shrubs and trees. No more than 20 percent of the individual seedlings can be browsed. Remove livestock from any area of the allotment when browsing indicates a change in livestock preference from grazing herbaceous vegetation to browsing woody riparian vegetation.
Soils			
X	Covered by existing law, regulation, or direction	Maintain long-term soil productivity; maintain and improve soil fertility, nutrient cycling, soil porosity, hydrologic function, and buffering capacity; minimize erosion.	Implement soil quality standards (as outlined in Appendix F). Attain standards for ground cover, compaction, and ground disturbance, so that the risk of sediment delivery to aquatic systems from management activities is minimized.
Fire			
X		Reduce size and severity of wildland fires.	Strategically place fuel treatments across the landscape to achieve fuel conditions that reduce the size and severity of wildfire. Maintain 30 to 40 percent of the landscape outside of the defense zone in a condition that meets fuels management objectives. Locate fuel treatments to interrupt wildfire spread and reduce fire severity, typically on the upper two-thirds of the slope, on south and west aspects, in mid- and lower-montane vegetation types. Treatments will occur in areas of high fire hazard and risk (see glossary for definition) in the following priority order (1) urban wildland intermix zone (2) old forest emphasis areas where threat from wildfire is greatest, (3) sensitive species habitats, and (4) general forest.
	X	Reduce size and severity of wildland fires.	Strategically place fuel treatments across the landscape to interupt fire spread and achieve conditions that reduce the size and severity of wildfire. Strategically placed area treatments should be treated to meet desired surface, ladder, and crown fuel conditions. Site-specific prescriptions should be designed to reduce fire intensity, reduce rate of fire spread, reduce crown fire potential, and reduce mortality in dominant and co-dominant trees. Managers should consider such variables as the topographic location of the treatment area, slope steepness, predominant wind direction, and the amount and arrangement of surface, ladder, and crown fuels in developing fuels treatment prescriptions. The first priority for treatment prescriptions for strategically placed area treatments is reducing surface and ladder fuels.

Forest Wide

S1	S2	Objective	Standard & Guideline
X		Reduce size and severity of wildland fires.	In plantations (timber strata classifications 0x, 1x, 2x, 3x), when applying the necessary silvicultural and fuels reduction treatments to accelerate development of old forest characteristics, increase stand heterogeneity, promote hardwoods, and reduce risk to loss from wildfire. Implement mechanical fuels treatments to remove material necessary to achieve the following outcomes from wildfire under the 90th percentile fire weather conditions: (1) wildfires burn with average flame lengths of 6 feet or less; and (2) rate of spread (ROS) is less than 50 percent of pre-treatment ROS and line production rate is doubled. Treatments should be effective for more than 5 years. Achieve these outcomes by reducing surface and ladder fuels and adjacent crown fuels.
	X	Reduce size and severity of wildland fires.	Where young plantations (generally Pacific Southwest Region size classes 0x, 1x, 2x) are included within area treatments, apply the necessary silvicultural and fuels reduction treatments to: (1) accelerate the development of key habitat and old forest characteristics, (2) increase stand heterogeneity, (3) promote hardwoods, and (4) reduce risk of loss to wildland fire. In size class 2x plantations, treatments should be designed to reduce fire intensity and rate of fire spread and reduce mortality to less than 50 percent of the stocking under 90th percentile conditions. Design fuel reduction projects to achieve the standards below. The standards are represented in a number of different ways to provide adequate flexibility in achieving the desired condition for treated areas. **Plantations (0x-2x):** ▪ 3 inches and smaller surface fuel load: less than 5 tons per acre, ▪ less than 0.5 foot fuel bed depth, ▪ less than 200 trees per acre, and ▪ less than 50 percent surface area with live fuels (brush)
X	Covered by other standards and guidelines	Landscape fuel reduction strategy	Incorporate fuel treatment and protection planning into reforestation plans. Ensure that tree stocking levels and silvicultural goals are consistent with fuel reduction objectives in plantations located within areas characterized by moderate to high fire risk and hazard.
	X	Fuel Reduction Standards	Design fuel reduction projects in conifer forest types (including 3x plantation types) to achieve the following standards within the treatment area**:** ▪ an average of 4-foot flame length under 90th percentile fire weather conditions. ▪ surface and ladder fuels removed as needed to meet design criteria of less than 20 percent mortality in dominant and co-dominant trees under 90th percentile weather and fire behavior conditions. ▪ tree crowns thinned to meet design criteria of less than 20 percent probability of initiation of crown fire under 90th percentile weather conditions.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	Covered by other standards and guidelines	Management of uses other than fire hazard reduction	Incidental removal of vegetation and coarse woody debris for activities such as administration of special use permits, maintenance of recreation developments, roads, trails, and rights of way, approved resort expansion plans, and removal of trees that represent imminent safety hazards may deviate from these vegetation management standards.
X		Management of uses other than fire hazard reduction	Exceptions from the vegetation management standards and guidelines may also include restoration activities, such as aspen regeneration, sugar pine management, Sequoia regeneration.
	X	Management of uses other than fire hazard reduction	Standards and gudielines for crown closure and tree diameter apply only to thinning and regeneration harvest. Exceptions to thevegetation management standards and guidelines include responding to pest infestation outbreaks and restoration activities, such as aspen regeneration, hardwood regeneration, sugar pine management, Sequoia regeneration.
Fisher			
X	X	Minimize old forest habitat fragmentation.	Assess potential impacts of fragmentation on old forest species (particularly fisher and marten) in biological evaluations. Evaluate locations of new landings, staging areas, recreational developments, including trails and other disturbances.
X	X	Ensure old forest habitat is present in sufficient locations and connectivity to sustain viable populations of forest carnivores.	Project level and landscape analysis includes consideration of forested linkages that are interconnected via riparian areas and ridgetop saddles with canopy closure greater than 40 percent.
X	X	Provide opportunities for the expansion of the fisher population beyond the Southern Sierra Fisher Conservation Area	If fishers are detected outside of the Southern Sierra Fisher Conservation Area, evaluate the habitat conditions and take appropriate mitigation measures to retain suitable habitat within the estimated home range and institute project level surveys over the appropriate landscape area.
Sierra Nevada Red Fox, Wolverine			
X		Limit potential impacts to wolverines or Sierra Nevada red foxes	Upon a detection (photograph, track plate, or siting verified by a wildlife biologist), perform an analysis to determine if activities within 5 miles of the detection have a potential to impact wolverines or Sierra Nevada red fox. For a period of two years following the detection, restrict activities from January 1 to June 30 that are determined in the analysis to have an adverse impact.

Forest Wide

S1	S2	Objective	Standard & Guideline
	X	Limit potential impacts to wolverines or Sierra Nevada red foxes	Detection of a wolverine or Sierra Nevada red fox will be validated by a forest carnivore specialist. When verified sightings occur, conduct an analysis to determine if activities within 5 miles of the detection have a potential to affect the species. Implement a limited operating period from January 1 to June 30 to avoid adverse impacts to potential breeding. Evaluate activities for a 2-year period for detections not associated with a den site.
Mining			
X	X	To return specially managed land allocations disturbed by mining-related activities to near pre-mining conditions.	Ensure that plan of operations, reclamation plans, and reclamation bonds address the costs of removing facilities, equipment, and materials; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; seedbed preparation and revegetation to meet the objectives of the land allocation in which the operation is located.
X	X	To maintain and restore the ecological integrity of specially managed land allocations.	Ensure that mine owner and operators limit the construction of new roads, decommission unnecessary roads, and maintain needed roads consistent with Forest Service roads policy and the objectives of the designated area.
X	X	Return specially managed land allocations (riparian areas, critical aquatic refuges, aquatic diversity areas, emphasis watersheds, protected activity centers, and old forest emphasis areas) disturbed by mining-related activities to near pre-mining conditions.	Require reclamation to be conducted in a timely manner.
X	X	To maintain and restore the ecological integrity of specially managed land allocations.	Require inspection and monitoring of mining-related activities on a regular basis to ensure compliance with laws, regulations, and operating plans. The frequency of inspections and monitoring should be based on the potential severity of mining activity impacts.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	X	Maintain the ecological integrity of specially managed land allocations (riparian areas, critical aquatic refuges, aquatic diversity areas, emphasis watersheds, protected activity centers, and old forest emphasis areas).	During mining related activities, limit the clearing of trees and other vegetation to the minimum necessary. Clearing of vegetation should be pertinent to the approved phase of mineral exploration and development,.
X	X	To protect the ecological integrity of aquatic, riparian, and meadow ecosystems from unstable solid mine waste facilities and potentially toxic releases.	Require solid waste facilities (e.g. waste rock and tailings dumps) to be located outside of Riparian Areas. Where no reasonable alternative to locating these mine waste facilities in Riparian Areas exists, locate and design them with the goal of ensuring stability and preventing potentially toxic releases. - (1) Mine waste material should be analyzed using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics. (2) Mine waste facilities should be located and designed using best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. (3) Reclamation and reclamation bonds should be sufficient to ensure long-term chemical and physical stability of mine waste facilities. (4) Waste and waste facilities should be monitored after operations have ceased to ensure that chemical and physical conditions are consistent with Aquatic Conservation Strategy goals.
X	X	To maintain the ecological integrity of aquatic, riparian, and meadow ecosystems.	Allow salable mineral activities such as sand and gravel mining and extraction within riparian areas only if measures that protect the integrity of aquatic, riparian, and meadow ecosystems are implemented.
Oaks/Hardwoods			
X	X	Maintain and enhance hardwood ecosystems	Manage hardwood ecosystems for a diversity of hardwood tree size classes within a stand, such that seedlings, saplings and pole size trees are in sufficient abundance to replace large trees that die.
X	X	Maintain and enhance critical wildlife habitat elements.	Retain the mix of mast producing species where they exist within a stand
X	X	Maintain or enhance distribution of hardwood ecosystems.	Retain all blue oak and valley oak trees except where National Forests have developed stand restoration strategies calling for tree removal, or where lost due to fire, or as needed for public health and safety.
X	X	Ensure and enhance oak regeneration.	Create openings where possible around existing California black and canyon live oaks where necessary to stimulate natural regeneration.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	X	Maintain and enhance biodiversity in lower westside ecosystems.	Consider risk of noxious weed spread, and minimize impacts to hardwood ecosystem structure and biodiversity in prescribed fire planning documents and in application of mechanical fuel treatments.
X	X	Maintain and enhance critical wildlife habitat elements.	During mechanical vegetation treatments, prescribed fire and salvage operations retain all large hardwood trees on the west side except where trees pose an immediate threat to human life or property, or where losses are incurred due to prescribed or wild fire. Large montane hardwoods are defined as having a dbh 12 inches or greater, blue oak woodland species are defined as having a dbh 8 inches or greater. Removal of larger hardwood trees (up to 20" dbh) would be permitted if research supports that it is necessary for maintenance and enhancement of the hardwood stand.
X	X	Maintain or enhance distribution of hardwood ecosystems.	Where commercial and noncommercial hardwood fuelwood and sawlog cutting in hardwood ecosystems are permitted, pre-mark or pre-cut hardwood trees to ensure stand goals are met. Retain a diverse distribution of stand cover classes.
X	X	Improve information base for hardwood species	During or prior to landscape analysis, spatially determine distributions of existing and potential natural hardwood ecosystems (FSH 2090.11). Assume pre-1850 disturbance levels for potential natural community distribution. Work with Province Ecologists or other qualified personnel to map and, or model hardwood ecosystems at the landscape scale (30,000-50,000 acres). Include the following items in the analysis; 1) compare distributions of potential natural and existing hardwood ecosystems, 2) Identify locations where existing is outside the natural range of variability for potential natural community, 3) identify hardwood restoration and enhancement projects.
X	X	Retain role of hardwoods in nutrient cycling and soil building	Include hardwoods in stand exams. Encourage hardwoods in plantations. Promote hardwoods after stand replacing events. Buffer around existing hardwood trees by not planting conifer trees within 20 feet from edge of hardwood crown canopy.
Old Forest Ecosystems and Associated Species			
X		Promote habitat connectivity in areas of mixed ownership	During landscape analysis, identify and prioritize areas for acquisition, exchange or conservation easements to enhance connectivity of habitat for old forest associated species.
	X	Promote habitat connectivity in areas of mixed ownership	During landscape analysis, identify areas for acquisition, exchange or conservation easements to enhance connectivity of habitat for old forest associated species.
X	X	Remove hazard trees to provide for public and employee safety.	Along maintenance level roads 3, 4, and 5 and within or immediately adjacent to (tree falling distance) administrative sites, hazard trees may be felled and removed. Along maintenance level 1 and 2 roads hazard trees will be reviewed by an appropriate resource specialist before felling. Trees that are needed to meet CWD will be left.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	X	Retain and restore habitat connectivity to facilitate movement of fishers and other old forest associated species.	Assess the potential impact of projects on the connectivity of habitat for old-forest associated species.
California Spotted Owl			
X		Consistent methodology for determining canopy cover	Aerial photography interpretation serves as the basis for determining canopy cover associated with stand retention guidelines for vegetation treatments and serves as the basis against which other methods must be calibrated. Since canopy cover is difficult to estimate with precision, monitoring the implementation of canopy cover standards using stand measurements must anticipate a degree of variation from the standard. Variation is acceptable provided that treatments have been planned and implemented using reasonable methods for estimating pre-treatment and projecting post-treatment canopy cover. Pre- and post- treatment canopy cover estimates from the ground should attempt to exclude trees less than 6 inches dbh since these trees contribute little to useable canopy cover for spotted owls but may substantially contribute to ladder fuels. Canopy cover estimates may be averaged over a treatment area up to 20-40 acres in size unless treated stands are smaller.
X		To limit the extent of stand structural changes from mechanical treatments	The structural change to treatment acres by mechanical methods is limited to one per decade. Treatments should be designed to be effective for at least 10 years. When subsequent entries within 10 years are needed to reduce surface fuels, prescribed fire is the preferred method. When burning opportunities are limited, mechanical treatments such as mastication and piling, are allowed.
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Retain snags 15 inches dbh or greater except (A) for imminent hazards to human safety, (B) following stand replacing events removal of dead trees may occur to the extent that project analysis recommends removal to benefit landscape conditions for old forest structure and function. Analysis should determine varying snag retention levels considering landscape position and site conditions (riparian areas, ridgetops, etc), avoiding uniformity across large areas.
	X	Fuel and Vegetation Treatments in Old Forest Emphasis Areas	Consider ecological benefits of retaining small patches of mortality in old forest emphasis areas.
X		Fuel Treatments in Forested patches or stands (greater than one acre in size) identified as CWHR 5M, 5D and 6 (outside the Defense Zone of the Urban Intermix).	Identify stands greater than 1 acre in size classified as CWHR 5M, 5D, and 6.

Forest Wide

S1	S2	Objective	Standard & Guideline
TEPS Plants			
X	Covered by existing law, regulation, or direction	Maintain long-term viability of threatened, endangered, proposed and sensitive (TEPS) plant species and ensure management activities do not contribute to population declines.	Conduct field surveys for TEPS plant species early enough in the project planning process that the project can be designed to conserve or enhance TEPS plants and their habitat. Conduct surveys according to procedures outlined in the Forest Service Handbook (FSH 2609.25.11). If additional field surveys are to be conducted as part of project implementation, survey results must be documented in the project file.
X	Covered by existing law, regulation, or direction	Maintain long-term viability of threatened, endangered, proposed and sensitive (TEPS) plant species and ensure management activities do not contribute to population declines.	Minimize or eliminate direct and indirect impacts from management activities to TEPS plants unless project is designed to maintain or improve populations. (FSM 2670)
X	Covered by existing law, regulation, or direction	To conserve the native biological diversity and adaptive capacity of plant communities, species, and populations, and to avoid displacing native plant species.	All projects involving revegetation (planting or seeding) will adhere to the Regional Native Plant Policy.
X	X	To ensure the persistence of bogs and fens, especially those containing Sphagnum moss, and the rare plants and bryophytes that are associated with these habitats.	Prohibit or mitigate ground-disturbing activities that negatively affect hydrologic processes that maintain water flow, water quality, or temperature critical to sustaining bog and fen ecosystems and the plant species dependent on them. During project analysis, survey, map and protect bogs and fens from activities such as trampling by livestock, pack stock, humans, and from wheeled vehicles. Criteria for defining bogs and fens include, but are not limited to: presence of sphagnum moss (Sphagnum spp.), presence of mosses in the genus Meesia, presence of sundew (Drosera ssp.). Complete initial inventories of fens and bogs within active grazing allotments prior to re-issuing permits.
Roads			
X		Minimize resource impacts from wheeled off-highway vehicle use.	Wheeled vehicle travel is allowed on designated routes, trails, and OHV areas. Unless otherwise restricted by current forest plans or other specific area standards and guidelines, cross-country travel by over-snow vehicles would continue. Each National Forest may designate where OHV use will occur.

Forest Wide

S1	S2	Objective	Standard & Guideline
	X	Minimize resource impacts from wheeled off-highway vehicle use.	Prohibit wheeled vehicle travel off of designated routes, trails, and limited OHV use areas. Unless otherwise restricted by current forest plans or other specific area standards and guidelines, cross-country travel by over-snow vehicles would continue.
X	Covered by existing law, regulation, or direction		Landscape analysis will include an integrated interdisciplinary transportation analysis. The analysis process will follow the National Roads Analysis procedures. Unclassified road inventories will be completed by each National Forest within ten years.
Vegetation Management			
X		Retain legacy elements important to future old forests, and biodiversity.	When implementing vegetation and fuels treatments, retain all live conifer trees with a dbh of 30 inches or greater in westside forest types and 24 inches or greater in the eastside pine forest type. Retain montane hardwoods 12 inches dbh or greater within westside forest types. Occasional mortality of larger trees will occur, however prescribed burn prescriptions and techniques are designed to minimize the loss of large trees and down material.
	X	Maintain and develop old forest habitat conditions by leaving the largest trees on site	When implementing mechanical thinning treatments, design projects to retain all live conifers 30 inches dbh or larger. Retain montane hardwoods 12 inches dbh or greater within westside forest types. Exceptions are allowed for operability. These trees count as part of basal area retention.
	X	Maintain and develop old forest habitat conditions by leaving the largest trees on site.	For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside defense zones: Design projects to retain at least 40 percent of the existing basal area. The retained basal area should generally be comprised of the largest trees. This standard and guideline does not apply to the eastside pine type.
	X	Allow project designers to address and balance the need to provide and develop understory structure as an important old forest habitat component with the need to reduce ladder and crown fuels.	For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside defense zones: Where available, design projects to retain 5 percent or more of the total treatment area in lower layers composed of trees 6 to 24 inches dbh within the treatment unit. This standard and guideline does not apply to the eastside pine type.

Forest Wide

S1	S2	Objective	Standard & Guideline
	X	Maintain high levels of canopy cover whenever it is possible to do so and still meet project objectives.	For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside defense zones: Where vegetative conditions permit, the goal is todesign projects to retain 50 percent canopy cover after treatment within the treatment unit, except where site-specific project objectives cannot be met (for example, to achieve adequate height to live crown, provide sufficient spacing for equipment operation, minimize re-entry, or design cost efficient treatments). Where 50 percent canopy cover retention cannot be met, as described above, design projects to retain a minimum of 40 percent canopy cover within the treatment unit. This standard and guideline does not apply to the eastside pine type.
	X	Where canopy cover is at or near 40 percent, maintain canopy closure conditions suitable for dispersal and foraging for California spotted owls while also allowing for effective fuels treatments.	For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside defense zones: Where pre-treatment canopy cover is at or near 40 percent, remove only surface and ladder fuels to achieve project fuels objectives. This standard and guideline does not apply to the eastside pine type.
	X	Avoid large changes in canopy density.	For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside defense zones: Design projects to avoid reducing pre-existing canopy cover by more than 30 percent within the treatment unit. Percent is measured in absolute terms (for example, do not reduce 80 percent canopy closure to less than 50 percent.) This standard and guideline does not apply to the eastside pine type
	X	Maintain and develop old forest habitat conditions by leaving the largest trees on site.	For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside defense zones in the eastside pine type: Design projects to retain 30 percent of the existing basal area. The retained basal area to be generally comprised of the largest trees. Projects in the eastside pine type have no canopy cover retention standards and guidelines.
X		Reduce size and severity of wildland fires.	Mechanical fuel treatments in brush and shrub patches are designed to remove material necessary to achieve the following outcomes from wildfire under 90th percentile fire weather conditions: (1) wildfires burn with an average flame length of 8 feet or less; and (2) rate of spread (ROS) is less than 50 percent of pre-treatment ROS and line production rate is doubled. Treatments are effective for more than 5 years.
	X	Reduce size and severity of wildland fires.	Design mechanical treatments in brush and shrub patches to remove the material necessary to achieve the following outcomes from wildland fire under 90th percentile fire weather conditions: (1) wildland fires would burn with an average flame length of 4 feet or less and (2) fire line production rates would be doubled. Treatments should be effective for more than 5-10 years.
X	X	Maintain shade intolerant species component in westside forest types	Promote shade intolerant pines (sugar and Ponderosa) and hardwoods in westside forest types.

Forest Wide

S1	S2	Objective	Standard & Guideline
Noxious Weeds			
X	Covered by existing law, regulation, or direction	Emphasize Integrated Weed Management as a guiding process for weed control.	When planning weed control projects, follow Forest Manual direction on Integrated Weed Management (FSM 2080)
X	X	Work with partners to educate people so that individuals voluntarily take measures to avoid spreading weeds	Inform forest users, local agencies, special use permitees, groups, and organizations in communities near national forests about noxious weed prevention and management.
X	X	Increase cooperation and coordination in order to more effectively prevent and control infestations.	Work cooperatively with the State of California, State of Nevada and individual counties (e.g. Cooperative Weed Management Areas), to prevent the introduction and establishment of noxious weed infestations and to control existing infestations.
X	X	Consider weed risk, prevention, and treatment in all NEPA documents.	Conduct a noxious weed risk assessment to determine low, moderate, or high risk for weed spread for various types of management activities. Refer to Weed Prevention Practices in Regional Noxious Weed Management Strategy to develop mitigation measures for high and moderate risk activities.
X	X	Maintain close contact with tribes and knowledgeable Native American individuals during all stages of implementation of integrated weed management.	Consult with Native Americans to determine priority areas for prevention and control where traditional gathering areas are threatened by weed infestations.
X	X	Minimize the introduction and establishment of noxious weed infestations as a result of heavy equipment.	As prescribed in the project weed risk assessment, require off-road equipment and vehicles (both Forest Service and contracted) used for project implementation to be weed free. Refer to Weed Prevention Practices in Regional Noxious Weed Management Strategy.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	X	Prevent or minimize the introduction and establishment of weeds as a result of pack or saddle stock and erosion control projects	Encourage use of certified weed free hay and straw. Cooperate in development of a certification program for weed free hay and straw. The program will be phased in as certified weed free hay and straw become available. This would apply to pack and saddle stock used by public, livestock permittees, outfitter guide permittees, and local, State, or Federal agencies.
X	X	Prevent the introduction and establishment of weeds as a result of ongoing management activities (e.g. road and campground maintenance, facility maintenance)	Minimize weed spread by incorporating prevention and control measures into any ongoing management or maintenance activities that involve ground disturbance or the possibility of spreading weeds. Refer to Weed Prevention Practices in Regional Noxious Weed Strategy.
X	X	Prevent the introduction and establishment of weeds as a result of Forest Service-issued permits.	Include weed prevention measures, as necessary, when amending and/or reissuing permits (including but not limited to livestock grazing, special uses, pack stock operators).
X	X	Prevent the introduction and establishment of weeds as a result of mining-related activities	Include weed prevention and treatment in plans of operation and reclamation. (Refer to Weed Prevention Practices in Regional Noxious Weed Strategy). As appropriate, monitor for weeds for 2 years after project implementation before assuming no introductions have occurred.
X	X	Ensure fire suppression and burned area emergency rehabilitation (BAER) activities do not contribute to weed spread.	Burned area emergency rehabilitation team conducts a risk analysis for weed spread as a result of BAER treatments. Monitor and treat weed infestations for 3 years after fire.
X	X	Ensure adequate data are available on the distribution and rate of spread of noxious weed species.	Complete noxious weed inventories based upon a regional protocol within 3 years of the signing of this record of decision. Review and update on an annual basis.
X	X	Contain and control established infestations.	As outlined in the Regional Noxious Weed Strategy, when new, small infestations are detected, emphasize eradication while providing for the safety of field personnel.

Forest Wide

S1	S2	Objective	Standard & Guideline
X	Covered by existing law, regulation, or direction	Restore ecological function where noxious weeds have resulted in degraded ecosystems	During landscape analysis or project level planning, consider restoration and revegetation of damaged ecosystems to minimize reinfestation. -- Adhere to the Regional Native Plant Policy for revegetation.
X	X	Ensure sufficient data is available to evaluate management actions, to assess progress towards management objectives and desired conditions.	Routinely monitor noxious weed control projects to determine success and evaluate need for follow-up treatments or different control methods. Monitor known infestations as appropriate to determine changes in density and rate of spread. Conduct follow-up inspections of ground disturbing activities to ensure compliance with the Regional noxious weed management strategy.
Willow Flycatcher			
X	X	Reduce the likelihood of willow flycatcher brood parasitism by brown-headed cowbirds.	Evaluate proposals for new concentrated stock areas (e.g. livestock handling and management facilities, pack stations, equestrian stations, and corrals) within five miles of occupied willow flycatcher habitat. Utilize a biological evaluation containing a broad landscape level analysis to determine if such action will increase brood parasitism pressure by brown-headed cowbird.

Forest Carnivore Den Sites

S1	S2	Objective	Standard & Guideline
Fisher			
X	X	Protect all known fisher natal (birthing) and maternal (kit rearing) den sites, and any located in the future	Protect verified fisher birthing and kit rearing dens from March 1 - June 30 with 700-acre buffers consisting of the highest quality habitat (CWHR size 4 or greater and canopy closure greater than 60%) in a compact arrangement surrounding the den site in the largest, most contiguous blocks available.
X		Protect all known fisher natal (birthing) and maternal (kit rearing) den sites, and any located in the future	Protect verified den sites with a limited operating period (LOP) for all new projects as long as habitat remains suitable, or until another regionally approved management strategy is implemented.
	X	Protect all known fisher natal (birthing) and maternal (kit rearing) den sites, and any located in the future	Protect verified den sites with a limited operating period (LOP) for vegetation treatments as long as habitat remains suitable, or until another regionally approved management strategy is implemented.
X	X	Protect all known fisher natal (birthing) and maternal (kit rearing) den sites, and any located in the future	The LOP may be waived for new individual projects of limited scope and duration, when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing, and specific location.
X	Covered by existing law, regulation, or direction	Protect all known fisher natal (birthing) and maternal (kit rearing) den sites, and any located in the future	Evaluate the appropriateness of LOPs for existing uses in fisher den site buffers during environmental analysis.
X	X	Protect habitat quality in fisher den site buffers	Where den site buffers occur in the urban wildland intermix, avoid fuel treatments to the extent possible. If areas within den site buffers must be treated to achieve fuels objectives, limit treatments to mechanical clearing of fuels. Treat ladder and surface fuels over 85% of the treatment unit to achieve fuels objectives. Use piling or mastication to treat surface fuels during initial treatment. Burning of piled debris is allowed. Prescribed fire may be used as a fuel treatment activity if no other reasonable alternative exists.
X		Protect den sites from disturbance due to roads, trails, off highway vehicle routes, recreational developments, and other developments	Evaluate proposals for new roads, trails, off highway vehicle routes, and recreational and other developments for their potential to disturb den sites. Mitigate impacts where there is documented evidence of disturbance to the den site from existing recreation, off highway vehicle route, trail, and road uses (including road maintenance)

Forest Carnivore Den Sites

S1	S2	Objective	Standard & Guideline
	X	Protect den sites from disturbance due to roads, trails, off highway vehicle routes, recreational developments, and other developments	Mitigate impacts where there is documented evidence of disturbance to the den site from existing recreation, off highway vehicle route, trail, and road uses (including road maintenance). Evaluate proposals for roads, trails, off highway vehicle routes, and recreational and other developments for their potential to disturb den sites.
Marten			
X	X	Designate marten den sites	Marten den sites are 100-acre buffers consisting of the highest quality habitat in a compact arrangement surrounding the den site. CWHR types 6, 5D, 5M, 4D, and 4M in descending order of priority, based on availability, provide highest quality habitat for the marten.
X		Protect known marten natal (birthing) and maternal (kit rearing) den sites, and any located in the future through research or monitoring.	Protect marten den site buffers from disturbance with a limited operating period (LOP) from May 1 through July 31 for all new projects as long as habitat remains suitable or until another regionally-approved management strategy is implemented.
	X	Protect known marten natal (birthing) and maternal (kit rearing) den sites, and any located in the future through research or monitoring.	Protect marten den site buffers from disturbance from vegetation treatments with a limited operating period (LOP) from May 1 through July 31 as long as habitat remains suitable or until another regionally-approved management strategy is implemented. The LOP may be waived for new individual projects of limited scope and duration, when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing, and specific location.
X		Protect den sites from disturbance due to roads, trails, off highway vehicle routes, recreational developments, and other developments	Evaluate proposals for new roads, trails, off highway vehicle routes, and recreational and other developments for their potential to disturb den sites. Mitigate impacts where there is documented evidence of disturbance to the den site from existing recreation, off highway vehicle route, trail, and road uses (including road maintenance).
	X	Protect den sites from disturbance due to roads, trails, off highway vehicle routes, recreational developments, and other developments	Mitigate impacts where there is documented evidence of disturbance to the den site from existing recreation, off highway vehicle route, trail, and road uses (including road maintenance). Evaluate proposals for roads, trails, off highway vehicle routes, and recreational and other developments for their potential to disturb den sites.

General Forest

S1	S2	Objective	Standard & Guideline
California Spotted Owl			
X		Fuel Treatments in General Forest (outside spotted owl PACs and home range core areas) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Design mechanical fuels treatments to remove the material necessary to achieve the following outcomes: Stands with <40% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 15 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions; Stands with 40 to 70% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 20 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions Stands with >70% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 25 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. Do not mechanically treat the remaining 25% of the stand area to contribute to stand heterogeneity.
X		Fuel Treatments in General Forest (outside spotted owl PACs and home range core areas) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Design prescribed fire treatments to achieve or approach the above fuels outcomes following up to two burns per decade and four burns over 20 years.
X		Fuel Treatments in General Forest (outside spotted owl PACs and home range core areas) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Design mechanical treatments to achieve the above fuels outcomes through understory thinning to remove surface and ladder fuels up to 20 inches in dbh. Apply treatments to increase stand heterogeneity. Canopy cover reductions may be needed to meet fuels objectives, but will not exceed a 20 percent reduction (i.e. 70% to 50%). Treatments will focus on removal of suppressed and intermediate conifer trees. When conducting treatments in dense stands with uniform tree size and spacing, introduce heterogeneity into the stand by creating small, irregularly spaced openings (typically less than one acre).
X		Fuel Treatments in General Forest (outside spotted owl PACs and home range core areas) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Within westside vegetation types where pre-treatment canopy cover is between 50-59%, design fuel treatments to retain a minimum of 50 percent canopy cover. Do not reduce canopy cover in stands currently between 40 and 50 percent canopy cover during fuels treatments except where this occurs from removal of primarily shade tolerant trees less than six inches in dbh. In the westside vegetation types, retain a minimum 50% canopy cover. In the eastside pine vegetation type, retain a minimum of 30 percent canopy cover.

Urban Wildland Intermix Threat Zone

S1	S2	Objective	Standard & Guideline
California Spotted Owl			
X		Fuel Treatments in Threat Zone of the Urban Wildland Intermix (outside spotted owl PACs) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Design mechanical fuels treatments to remove material necessary to achieve the following outcomes:Stands with <40% canopy cover: over 85 percent of the stand area, achieve an average height to live crown of 15 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions; Stands with 40 to 70% canopy cover: over 85 percent of the stand area, achieve an average height to live crown of 20 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions Stands with >70% canopy cover: over 85 percent of the stand area, achieve an average height to live crown of 25 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. Do not mechanically treat the remaining 15% of the stand area to contribute to stand heterogeneity.
X		Fuel Treatments in Threat Zone of the Urban Wildland Intermix (outside spotted owl PACs) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Design prescribed fire treatments to achieve the above fuels outcomes following up to two burns per decade and four burns over 20 years.
X		Fuel Treatments in Threat Zone of the Urban Wildland Intermix (outside spotted owl PACs) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Achieve the above outcomes by understory thinning to remove surface and ladder fuels up to 20 inches in dbh. Canopy cover reductions may be needed to meet fuels objectives, but will not exceed a 20 percent reduction (i.e. 70% - 50%). Treatments will focus on removal of suppressed and intermediate trees. Increase stand heterogeneity through use of non-uniform treatments. When conducting fuels treatments in dense stands with uniform tree size and spacing, introduce heterogeneity into the stand by creating small, irregularly spaced openings (typically less than one acre in size).
X		Fuel Treatments in Threat Zone of the Urban Wildland Intermix (outside spotted owl PACs) for Forested stands other than plantations and CWHR 5M, 5D and 6:	In westside forest types, where pre-treatment canopy cover is between 50 and 59 percent, design mechanical treatments to retain a minimum of 50 percent canopy cover. Do not reduce canopy cover in stands currently between 40 and 50 percent canopy cover except where this occurs from removal of primarily shade tolerant trees less than six inches in dbh. In the eastside pine vegetation type, retain a minimum of 30 percent canopy cover.
X		Fuel Treatments in Threat Zone of the Urban Wildland Intermix (outside spotted owl PACs) for Forested stands other than plantations and CWHR 5M, 5D and 6:	Conduct an analysis of suitable owl habitat around activity centers before applying the mechanical treatments described above. If sufficient suitable owl habitat exists within 1½ miles of the activity center to satisfy the home range core area delineation standards and guidelines, the area outside the PAC may be treated as described above. The mechanical treatments described above may not be applied within 1½ miles of the nest site or activity center where the requirements of a home range core area cannot be met; however, these areas may be treated according to the mechanical fuel treatment standards and guidelines for old forest emphasis areas. Document this site-specific analysis in the environmental analysis.

Old Forest Emphasis and Owl Home Range Core Areas

S1	S2	Objective	Standard & Guideline
California Spotted Owl			
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Design mechanical fuels treatments to remove material necessary to achieve the following outcomes: ▪ Stands with <40% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 15 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. ▪ Stands with 40 to 70% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 20 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. ▪ Stands with >70% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 25 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. To enhance stand heterogeneity and maintain intact biological processes, particularly soil biota that may be effected by mechanical treatments, do not mechanically treat the remaining 25% of the stand area.
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Where mechanical treatments are necessary, design treatments to achieve or approach the fuels outcomes described above through the reduction of surface and ladder fuels less than 12 inches in dbh. Apply treatments to increase stand heterogeneity. Incidental felling of trees 12 to 20” dbh is permitted where required for operability. Retain felled trees on the ground where needed to achieve down material standards of 20 tons per acre in logs greater than 12 inches dbh.
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Give priority to restoration of historic fire return intervals where possible. Emphasize restoration of fire to pine and mixed-conifer forests. In mixed-conifer forests, fire return intervals vary by aspect and topographic position, with most frequent burning on south and west facing aspects.
X		Fuel Treatments in Forested patches or stands (greater than one acre in size) identified as CWHR 5M, 5D and 6 (outside the Defense Zone of the Urban Intermix)	Design prescribed fire treatments to achieve the following fuels outcomes in RX21C following up to two burns per decade and four burns over 20 years.
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Emphasize treatments in low elevation high hazard mixed conifer, eastside pine and mixed-conifer, and pine types on the upper two-thirds of south and west facing slopes near roads. Mechanical fuels treatments will be utilized where excessive smoke is a concern, the risk of escape of prescribed fire is substantial or in stands with excessive surface and ladder fuels in high fuel hazard and risk areas that preclude the use of prescribed fire alone without risk to loss of canopy structure.

Old Forest Emphasis and Owl Home Range Core Areas

S1	S2	Objective	Standard & Guideline
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Do not reduce canopy cover in dominant and co-dominant trees by more than 10 percent across the patch or stand following mechanical vegetation treatments (e.g. 80% to 70%, or 65% to 55%).
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Within westside vegetation types where pre-treatment canopy cover is between 50-59%, design mechanical treatments to retain a minimum of 50 percent canopy cover. Do not reduce canopy cover in stands currently between 40 and 50 percent canopy cover except where this occurs from removal of primarily shade tolerant trees less than six inches in dbh. In the eastside pine vegetation type, retain a minimum of 30 percent canopy cover.
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Strategically placed area fuel treatments may be needed in old forest emphasis areas to minimize risks to human life and property, sensitive resources, or the old forest emphasis area from loss to wildfire. When treatments are necessary, prescribed fire is the first priority for achieving the fuels objectives. When prescribed fire will not achieve fuels objectives, use mechanical thinning as described in the preceding paragraphs to achieve the fuels objectives. When this treatment will not achieve the fuels objectives due to existing stand conditions, mechanical thinning of trees up to 20 inches dbh and canopy reductions of up to 20 percent (refer to mechanical treatment standards and guidelines for the threat zone) may be conducted in CWHR 4M and 4D stands to meet fuels reduction objectives.
X		Fuel Treatments in Old Forest Emphasis Areas and Spotted Owl Home Range Core Areas	Conduct an analysis of suitable owl habitat before applying mechanical treatments that remove trees up to 20 inches dbh and reduce canopy cover up to 20 percent in old forest emphasis areas. This type of treatment may only be used when sufficient suitable owl habitat exists within 1½ miles of a California spotted owl nest site or activity center to satisfy the requirements of a home range core area, as described in the standards and guidelines for delineating California spotted owl home range core areas. This type of treatment may not be applied within 1½ miles of the nest site or activity center if the requirements for delineating a home range core area cannot be met. Document this site-specific analysis in the environmental analysis.

Old Forest Patches or Stands

S1	S2	Objective	Standard & Guideline
X		Fuel Treatments in Forested patches or stands (greater than one acre in size) identified as CWHR 5M, 5D and 6 (outside the Defense Zone of the Urban Intermix)	Design mechanical fuels treatments to remove the material necessary to achieve the following outcomes: ▪ Stands with <40% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 15 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. ▪ Stands with 40 to 70% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 20 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. ▪ Stands with >70% canopy cover: over 75 percent of the stand area, achieve an average height to live crown of 25 feet and an average flame length of six feet or less if the stand were to burn under 90th percentile fire weather conditions. Do not mechanically treat the remaining 25% of the stand to enhance stand heterogeneity and maintain intact biological processes, particularly soil biota that may be effected by mechanical treatments.
X		Fuel Treatments in Forested patches or stands (greater than one acre in size) identified as CWHR 5M, 5D and 6 (outside the Defense Zone of the Urban Intermix)	Design mechanical treatments to achieve or approach the above fuels outcomes through the removal of surface and ladder fuels less than 12 inches in dbh. Incidental felling of trees 12 to 20 inches dbh is permitted only where required for operability. Retain felled trees on the ground where needed to achieve down material standards of 10-20 tons per acre in logs greater than 12 inches diameter at the midpoint.
X		Fuel Treatments in Forested patches or stands (greater than one acre in size) identified as CWHR 5M, 5D and 6 (outside the Defense Zone of the Urban Intermix)	Do not reduce canopy cover by more than 10 percent in the dominant or co-dominant trees across the patch or stand following vegetation treatments (e.g. 80% to 70%, or 65% to 55%).
X		Fuel Treatments in Forested patches or stands (greater than one acre in size) identified as CWHR 5M, 5D and 6 (outside the Defense Zone of the Urban Intermix)	In westside forest types, where pre-treatment canopy cover is between 50-59%, design mechanical treatments to retain a minimum of 50 percent canopy cover. Do not reduce canopy cover in stands currently between 40 and 50 percent canopy cover except where this occurs from removal of trees less than six inches in dbh. In the eastside pine vegetation type, retain a minimum of 30 percent canopy cover.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
Owls, Goshawk			
X		Prevent disturbance of PAC's	Evaluate proposals for new roads, trails, OHV routes, recreation and other developments for their potential to disturb nesting or denning sites. Mitigate impacts where there is evidence of disturbance to the nest or den site from existing recreation, OHV routes, trail, and road uses (including road maintenance).
	X	Prevent disturbance of PAC's	Mitigate impacts where there is documented evidence of disturbance to the nest site from existing recreation, off highway vehicle route, trail, and road uses (including road maintenance). Evaluate proposals for roads, trails, off highway vehicle routes, and recreational and other developments for their potential to disturb nest sites.
Goshawk			
X	X	Designation of Northern Goshawk Protected Activity Centers (PACs)	Delineate northern goshawk protected activity centers (PACs) surrounding all known and newly discovered breeding territories detected on National Forest System lands. Northern goshawk PACs are designated based upon the latest documented nest site and the location(s) of alternate nests, or the location of territorial adult birds or recently fledged juvenile goshawks during the fledgling dependency period if the actual nest site is not located.
X	X	Designation of Northern Goshawk Protected Activity Centers (PACs)	PACs are delineated to include the known and suspected nest stands, and encompass the best available 200-acres of forested habitat in the largest contiguous patches that are possible based on aerial photography. When suitable nesting habitat occurs in small patches, PACs can be defined as multiple blocks in the largest patches available within 0.5 miles of one another. The best available forested stands for PACs should be selected to incorporate where available: (1) trees in the dominant and co-dominant crown classes averaging at least 24 inches dbh, and (2) at least 70% tree canopy cover in westside conifer and eastside mixed conifer forests, and at least 60% tree canopy cover in eastside pine forests. Non-forest vegetation (e.g., brush, meadows, etc.) should not be counted as part of the 200 acres.
X	X	Designation of Northern Goshawk Protected Activity Centers (PACs)	When activities are planned within or adjacent to a PAC, conduct surveys to establish or confirm the location of the nest or activity center, if uncertain.
X	X	Designation of Northern Goshawk Protected Activity Centers (PACs)	When activities are planned adjacent to non-Forest Service lands, check available databases for the presence of nearby goshawk activity centers. Delineate a 200-acre circular area centered around the activity center. Designate and manage any region of the circular 200-acre area occurring on National Forest lands as a goshawk PAC.
X		Designation of Northern Goshawk Protected Activity Centers (PACs)	Review boundaries of PACs and make adjustments as necessary to better meet these criteria as additional nest location and habitat data become available. PACs are maintained regardless of goshawk occupancy status unless habitat is rendered unsuitable by a catastrophic stand-replacing event and protocol surveys confirm non-occupancy.
	X	Designation of Northern Goshawk Protected Activity Centers (PACs)	Review boundaries of PACs and make adjustments as necessary to better meet these criteria as additional nest location and habitat data become available. PACs are maintained regardless of goshawk occupancy status unless surveys conducted to protocol in remaining suitable habitat following stand-replacing events confirm non-occupancy.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
X		Maintain habitat within Northern Goshawk Protected Activity Centers (PACs)	Within Protected Activity Centers outside of the Defense Zone of the Urban Wildland Intermix, limit stand-altering activities in northern goshawk PACs to reduction of surface and ladder fuels through prescribed fire treatments. In forested stands with overstory trees 11 inches in dbh and greater, design prescribed fire treatments that have an average flame length of 4 feet. Conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh) as necessary within a one to two acre area surrounding known nest trees prior to burning to protect the nest tree and the trees in its immediate vicinity.
	X	Maintain habitat within Northern Goshawk Protected Activity Centers (PACs)	In PACs located outside the defense zone of the wildland urban intermix zone use prescribed fire treatments to address fuels and forest health issues with the following exception for threat zones only: Mechanical treatments are allowed where prescribed fire is not feasible, and where avoiding PACs would significantly compromise the overall effectiveness of the landscape fire and fuels strategy. Design mechanical treatments to maintain habitat structure and function of the PAC.
	X	Maintain habitat within Northern Goshawk Protected Activity Centers (PACs)	In PACs located in WUI defense and threat zones: Mechanical treatments are prohibited within a 500-foot radius buffer around a spotted owl activity center within the designated PAC. Allow prescribed burning within the 500-foot radius buffer. Prior to burning conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), as needed to protect important elements of owl habitat. The remainder of the PAC may be mechanically treated using the forest-wide standards and guidelines for mechanical thinnings.
X		Maintain habitat within Northern Goshawk Protected Activity Centers (PACs)	Within Protected Activity Centers inside of the Defense Zone of the Urban Wildland Intermix, mechanical treatments are prohibited within a 500-foot radius buffer around northern goshawk nest trees within PACs. Allow prescribed burning within the 500-foot radius buffer. Conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh) as necessary within a one to two acre area surrounding known nest trees prior to burning to protect the nest tree and the trees in its immediate vicinity. The remainder of the PAC may be mechanically treated to achieve the fuels reduction outcomes for General Forest.
X		Maintain habitat within Northern Goshawk Protected Activity Centers (PACs)	Conduct mechanical treatments in no more 5 percent per year and no more than 10 percent per decade of the northern goshawk PACs until a formal monitoring and adaptive management approach is developed in coordination with PSW research station. Breeding season limited operating period restrictions may be waived, where necessary, to allow for use of early season prescribed fire in up to five percent of PACs per year on a forest.
	X	Maintain habitat within Northern Goshawk Protected Activity Centers (PACs)	Conduct mechanical treatments in no more than 5 percent per year and 10 percent per decade of the acres in northern goshawk PACs until a formal monitoring and adaptive management approach is developed in coordination with PSW research station. Breeding season limited operating period restrictions may be waived, where necessary, to allow for use of early season prescribed fire in up to five percent of PACs per year on a forest.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
X		Avoid northern goshawk breeding disturbance	Maintain a limited operating period (LOP), prohibiting activities within approximately ¼ mile of the nest site during the breeding season (February 15 through September 15) unless surveys confirm that northern goshawks are not nesting. If the nest stand within a protected activity center (PAC) is unknown, either apply the LOP to a ¼- mile area surrounding the PAC, or survey to determine the nest stand location. The LOP does not apply to existing road and trail use and maintenance, or continuing recreation use, except where analysis of proposed projects or activities determines that such activities are likely to result in nest disturbance. The LOP may be waived for individual projects or activities of limited scope and duration or when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. Where a biological evaluation concludes that a nest site would be shielded from planned activities by topographic features that would minimize disturbance, the LOP buffer distance may be reduced.
	X	Avoid northern goshawk breeding disturbance	Maintain a limited operating period (LOP), prohibiting vegetation treatments within approximately ¼ mile of the nest site during the breeding season (February 15 through September 15) unless surveys confirm that northern goshawks are not nesting. If the nest stand within a protected activity center (PAC) is unknown, either apply the LOP to a ¼-mile area surrounding the PAC, or survey to determine the nest stand location. The LOP may be waived for vegetation treatments of limited scope and duration, when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. Where a biological evaluation concludes that a nest site would be shielded from planned activities by topographic features that would minimize disturbance, the LOP buffer distance may be reduced.
X		Northern Goshawk Survey Requirements	Conduct surveys in compliance with the Pacific Southwest Region's survey protocols prior to undertaking management activities likely to reduce habitat quality but proposed within suitable northern goshawk nesting habitat (defined as stands with an average tree size of at least 11 inches dbh and canopy cover of at least 20% in eastside pine forests, and an average of at least 11 inches dbh and canopy cover of at least 40% in the other forest types) that is not within an existing owl or goshawk PAC.
	X	Northern Goshawk Survey Requirements	Conduct surveys in compliance with the Pacific Southwest Region's survey protocols during the planning process when management activities are likely to reduce habitat quality but are proposed within suitable northern goshawk nesting habitat that is not within an existing California spotted owl or northern goshawk PAC. Suitable habitat is defined based on the survey protocol.
Great Gray Owl			
X	X	Maintain existing nesting and roosting habitats in a condition suitable for continued use by great gray owls for those purposes.	Establish and maintain a protected activity center that includes the forested area and adjacent meadow around all known great gray owl nest stands. Delineate at least 50 acres of the highest quality nesting habitat available in the forested area surrounding the nest. Also include the meadow or meadow complex that supports the prey base for nesting owls. Reliable sitings of great gray owls should be followed up with additional surveys to established protocols.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
X		Prevent loss of reproductive success from activity-caused disturbance to great gray owls.	Apply a limited operating period to management activities within 0.25 miles of an active great gray owl nest stand during the nesting period (typically March 1 to August 15). Engage in no stand or ground altering activities, road construction during this period. Prohibit management activities within 0.25 miles of the nest site during the breeding season unless surveys confirm that great gray owls are not nesting. The LOP does not apply to existing road traffic and maintenance, trail and other recreational uses and activities, except where a biological evaluation determines the activities will result in nest disturbance. The limited operating period may also be waived for projects of limited scope and duration.
	X	Prevent loss of reproductive success from activity-caused disturbance to great gray owls.	Apply a limited operating period, prohibiting vegetation treatments and road construction within 0.25 miles of an active great gray owl nest stand, during the nesting period (typically March 1 to August 15). The LOP may be waived for vegetation treatments of limited scope and duration, when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. Where a biological evaluation concludes that a nest site would be shielded from planned activities by topographic features that would minimize disturbance, the LOP buffer distance may be reduced.
X		Surrounding active great gray owl nests, provide suitable habitat for the prey species of great gray owls, such as pocket gophers and voles.	Maintain herbaceous meadow vegetation at least 12 inches in height and covering at least 90 percent of the meadow, within great gray owl protected activity centers.
	X	Surrounding active great gray owl nests, provide suitable habitat for the prey species of great gray owls, such as pocket gophers and voles.	In meadow areas of great gray owl PACs, maintain herbaceous vegetation at a height commensurate with site capability and habitat needs of prey species. Follow regional guidance to determine potential prey species and associated habitat requirements at the project level.
California Spotted Owl			
X	X	Designation of Spotted Owl Protected Activity Centers (PACs)	Delineate California spotted owl protected activity centers (PACs) surrounding each territorial owl activity center detected on National Forest System lands since 1986 using aerial photo interpretation with field verification where needed. Owl activity centers are designated based upon the latest documented nest site, the latest known roost site when a nest location remains unknown, and as a central point based upon repeated daytime detections when neither nest nor roost locations are known for all territorial owls.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
X		Designation of Spotted Owl Protected Activity Centers (PACs)	PACs are delineated, using aerial photography, to include the known and suspected nest stands, and encompass the best available 300-acres of habitat in as compact a unit as possible. The best available habitat for PAC's should be selected to incorporate where available): (1) two or more tree canopy layers; (2) trees in the dominant and co-dominant crown classes averaging at least 24 inches dbh, and (3) at least 70% tree canopy cover (including hardwoods); and (4) in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and other stands with at least 50% canopy cover (including hardwoods).
	X	Designation of Spotted Owl Protected Activity Centers (PACs)	PACs are delineated, using aerial photography, to include the known and suspected nest stands, and encompass the best available 300-acres of habitat in as compact a unit as possible. The best available habitat for PAC's should be selected to incorporate where available), in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and other stands with at least 50% canopy cover (including hardwoods).
X	X	Designation of Spotted Owl Protected Activity Centers (PACs)	Review boundaries of PACs and make adjustments as necessary to better meet these criteria as additional location and habitat data become available.
X	X	Designation of Spotted Owl Protected Activity Centers (PACs)	When activities are planned within or adjacent to a PAC, conduct surveys to establish or confirm the location of the nest or activity center, if uncertain. When Forest Service activities are planned adjacent to non-Forest Service lands, check available databases for the presence of nearby owl activity centers. Delineate a 300 acre circular area centered around the activity center. Designate and manage any region of the circular 300-acre area occurring on National Forest lands as an owl PAC.
X		Designation of Spotted Owl Protected Activity Centers (PACs)	PACs are maintained regardless of owl occupancy status unless habitat is rendered unsuitable by a catastrophic stand-replacing event and protocol surveys confirm non-occupancy.
	X	Designation of Spotted Owl Protected Activity Centers (PACs)	PACs are maintained regardless of California spotted owl occupancy status unless surveys conducted to protocol in remaining suitable habitat following stand-replacing events confirm non-occupancy.
X		Fuel Treatments in Protected Activity Centers	Conduct vegetation treatments in no more than 5 percent per year and 10 percent per decade of the California spotted owl PACs in the 11 Sierra Nevada national forests until a formal monitoring and adaptive management approach is developed in coordination with the Pacific Southwest Research Station. Monitor the number of PACs treated at a bioregional scale. Update the total number of PACs to account for losses of PACs due to catastrophic events.
	X	Fuel Treatments in Protected Activity Centers	Conduct vegetative treatments in no more than 5 percent per year and 10 percent per decade of the acres in California spotted owl PACs in the 11 Sierra Nevada national forests until a formal monitoring and adaptive management approach is developed in coordination with the Pacific Southwest Research Station. Monitor the number of PACs treated at a bioregional scale. Update the total number of PACs to account for losses of PACs due to catastrophic events.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
X		Avoidance of Breeding Disturbance	Maintain a limited operating period (LOP), prohibiting activities within approximately ¼ mile of the activity center during the breeding season (March 1 through August 31) unless surveys confirm that California spotted owls are not nesting. The LOP does not apply to existing road and trail use and maintenance, or continuing recreation use, except where analysis of proposed projects or activities determines that such activities are likely to result in nest disturbance. The LOP may be waived for individual projects or activities of limited scope and duration or when a biological evaluation determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. Where a biological evaluation determines that a nest site would be shielded from planned activities by topographic features that would minimize disturbance, the LOP buffer distance may be reduced.
	X	Avoidance of Breeding Disturbance	Maintain a limited operating period (LOP), prohibiting vegetation treatments within approximately ¼ mile of the activity center during the breeding season (March 1 through August 31), unless surveys confirm that California spotted owls are not nesting. The LOP may be waived for projects of limited scope and duration or when a biological evaluation documents that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. Where a biological evaluation determines that a nest site would be shielded from planned activities by topographic features that would minimize disturbance, the LOP buffer distance may be reduced.
X		Avoidance of Breeding Disturbance	When activities are planned within or adjacent to a PAC and the location of the nest site or activity center is uncertain, conduct surveys to establish or confirm the location of the nest or activity center
	X	Avoidance of Breeding Disturbance	When vegetation treatments are planned within or adjacent to a PAC and the location of the nest site or activity center is uncertain, conduct surveys to establish or confirm the location of the nest or activity center.
X		Spotted Owl Survey Requirements	Conduct surveys in compliance with the Pacific Southwest Region's survey protocols prior to undertaking vegetation treatments in spotted owl habitat with unknown occupancy and designate PACs where appropriate according to survey results.
	X	Spotted Owl Survey Requirements	Conduct surveys in compliance with the Pacific Southwest Region's survey protocols during the planning process when vegetation treatments likely to reduce habitat quality are proposed in suitable California spotted owl habitat with unknown occupancy. Designate California spotted owl protected activity centers (PACs) where appropriate based on survey results.
X		Fuel Treatments in Protected Activity Centers outside of the Defense Zone of the Urban Intermix Zone	Limit stand-altering activities to reducing surface and ladder fuels through prescribed fire treatments. In forested stands with overstory trees 11 inches dbh and greater, design prescribed fire treatments that have an average flame length of 4 feet or less. Prior to burning, conduct hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), within a 1- to 2-acre area surrounding known nest trees as needed to protect nest trees and trees in their immediate vicinity.

PACs, Den Sites

S1	S2	Objective	Standard & Guideline
	X	Fuel Treatments in Protected Activity Centers outside of Defense and Threat Zones of the Wildland Urban Intermix Zone	Limit stand-altering activities to reducing surface and ladder fuels through prescribed fire treatments. In forested stands with overstory trees 11 inches dbh and greater, design prescribed fire treatments that have an average flame length of 4 feet or less. Hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches dbh), may be conducted prior to burning as needed to protect important elements of owl habitat.
	X	Fuel Treatments in Protected Activity Centers in Threat Zones of the Urban Intermix Zone.	Limit stand altering treatments as above with the following exception: Mechanical treatments are allowed where avoiding all PACs would significantly compromise the overall effectiveness of the landscape fire and fuels strategy. Within the assessment area or watershed, locate fuels treatments to minimize impacts to PACs. When treatment areas must intersect PACs and choices can be made about which PACs to enter, use the following criteria to preferentially avoid PACs that have the highest likely contribution to owl productivity. (1) Lowest contribution to productivity: 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, (5) Highest contribution to productivity: PACs currently or historically reproductive. Historical occupancy is considered occupancy since 1990. Current occupancy is based upon surveys consistent with survey protocol (March 1992) in the last 2-3 years prior to project planning. These dates were chosen to encompass the majority of survey efforts and to included the breeding pulses in the early 1990s when many sites were found to be productive. When designing treatment unit intersections with PACs, limit treatment acres to those necessary to achieve strategic placement objectives and avoid treatments adjacent to nest stands whenever possible.

Southern Sierra Fisher Conservation Area

S1	S2	Objective	Standard & Guideline
X		Avoid degrading fisher habitat	Prior to vegetation treatments, identify important wildlife structures such as large diameter snags and coarse woody debris within the treatment unit. Use firing patterns, lining of snags and large logs, and other techniques to minimize effects to snags and large logs. Evaluate the effectiveness of these mitigation measures after treatment.
	X	Avoid degrading fisher habitat	Prior to vegetation treatments, design measures to protect important habitat structures as identified by the wildlife biologist, such as large diameter snags and oaks, patches of dense large trees typically ¼ to 2 acres, large trees with cavities for nesting, clumps of small understory trees, and coarse woody material. For example, use firing patterns, place fire lines around snags and large logs, and implement other prescribed burning techniques to minimize effects to these attributes. Use mechanical treatments when appropriate to minimize effects on preferred fisher habitat elements.
X		Maintain suitable habitat for fishers throughout the Southern Sierra Fisher Conservation Area	In areas within the SSFCA that are outside of the urban interface, manage each planning watershed to support fisher habitat requirements. Retain 60% of each 5,000-10,000 acre watershed in CWHR 4 (11-24” dbh) or greater and canopy closure greater than or equal to 50%
X			Manage the portions of the southern Sierra fisher conservation area that overlap with old forest emphasis areas (as mapped for Modified Alternative 8 of the FEIS: the map layer is available upon request) according to the standards and guidelines for old forest emphasis areas. Manage portions of the southern Sierra fisher conservation area that do not overlap with old forest emphasis areas according to the standards and guidelines for the general forest allocation. Because the effects of prescribed fire on key components of fisher habitat are uncertain, give preference to mechanical treatments over prescribed fire. However, prescribed fire may be applied to achieve restoration and regeneration objectives for fire-adapted giant sequoia.

Herger-Feinstein Quincy Library Group Pilot Project Area

S1	S2	HFQLG Land Allocation	Management Direction (applies until the HFQLG Pilot Project is completed)
	X	Offbase and deferred areas	The following HFQLG resource management activities are prohibited: DFPZ construction, group selection, individual tree selection, all road building, all timber harvesting activities, and any riparian management that involves road construction or timber harvesting.
	X	Late successional old growth (LSOG) rank 4 and 5	Group selection and individual tree selection are not allowed in LSOG 4 and 5 stands. DFPZ construction is allowed in LSOG 4 and 5 stands. Design DFPZs to avoid old forest stands (CWHR classes 5M, 5D, 6) within this allocation.
	X	California spotted owl PACs	The following resource management activities--DFPZs, group selection, individual tree selection, and riparian restoration projects and other timber harvesting--are not allowed within spotted owl PACs.
	X	California spotted owl habitat areas (SOHAs)	The following resource management activities--DFPZs, group selection, individual tree selection, and riparian restoration projects and other timber harvesting--are not allowed within spotted owl SOHAs.
	X	National forest lands outside of the above allocations and available for vegetation and fuels management activities specified in the HFQLG Act	**DFPZs**
			Eastside pine types and all other CWHR 4M and 4D classes: ▪ Design projects to retain at least 30% of existing basal area, generally comprised of the largest trees. ▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable. ▪ For CHWR 4M and 4D classes that are not eastside pine types, retain, where available, 5% of total post-treatment canopy cover in lower layers composed of trees 6--24-inches dbh. No other canopy cover requirements apply.
			CWHR 5M, 5D, and 6 classes except those referenced above: ▪ Design projects to retain a minimum of 40% canopy cover. ▪ Design projects to avoid reducing pre-treatment canopy cover by more than 30%. ▪ Design projects to retain at least 40% of existing basal area, generally comprised of the largest trees. ▪ Design projects to retain, where available, 5% of total post-treatment canopy cover in lower layers composed of trees 6-24 inches dbh. Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.
			All other CWHR class stands: Retain all live trees ≥30 inches dbh, except to allow for operations. Minimize operations impacts to ≥30-inch trees as much as practicable.

Herger-Feinstein Quincy Library Group Pilot Project Area

<table>
<tr><th>S1</th><th>S2</th><th>HFQLG Land Allocation</th><th>Management Direction (applies until the HFQLG Pilot Project is completed)</th></tr>
<tr><td rowspan="5"></td><td rowspan="5">X</td><td rowspan="5">National forest lands outside of the above allocations and available for vegetation and fuels management activities specified in the HFQLG Act</td><td>Group selection</td></tr>
<tr><td>Design projects to retain all live trees ≥30 inches dbh, except allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.</td></tr>
<tr><td>Area thinning (individual tree selection)
<u>All eastside pine types:</u>
▪ Design projects to retain at least 30% of existing basal area, generally comprised of the largest trees
▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.
▪ Canopy cover change is not restricted.</td></tr>
<tr><td><u>CWHR classes 4D, 4M, 5D, 5M and 6 (except eastside pine type):</u>
▪ Where vegetative conditions permit, design projects to retain ≥50% canopy cover after treatment averaged within the treatment unit, except where site-specific project objectives cannot be met. Where 50 percent canopy cover retention cannot be met as described above, design projects to retain a minimum of 40% canopy cover averaged within the treatment unit.
▪ Design projects to avoid reducing canopy cover by more than 30% from pre-treatment levels.
▪ Design projects to retain at least 40% of the existing basal area, generally comprised of the largest trees.
▪ Design projects to retain, where available, 5% of total post-treatment canopy cover in lower layers composed of trees 6-24 inches dbh.
▪ Design projects to retain all live trees ≥30 inches dbh; exceptions allowed for operability. Minimize impacts to ≥30-inch trees as much as practicable.</td></tr>
</table>

Herger-Feinstein Quincy Library Group Pilot Project Area

S1	S2	HFQLG Land Allocation	Management Direction (applies until the HFQLG Pilot Project is completed)
			Down wood and snags ▪ Determine retention levels of down woody material on an individual project basis. Within westside vegetation types, generally retain an average over the treatment unit of 10-15 tons of large down wood per acre. Within eastside vegetation types, generally retain an average of three large down logs per acre. Emphasize retention of wood that is in the earliest stages of decay. Consider the effects of follow-up prescribed fire in achieving desired retention levels of down wood. ▪ Determine snag retention levels on an individual project basis. Design projects to sustain across a landscape a generally continuous supply of snags and live decadent trees suitable for cavity nesting wildlife. Retain some mid and large diameter live trees that are currently in decline, have substantial wood defect, or have desirable characteristics (teakettle branches, large diameter broken top, large cavities in the bole) to serve as future replacement snags and to provide nesting structure. When determining snag retention levels, consider land allocation, desired condition, landscape position, and site conditions (such as riparian areas and ridge tops), avoiding uniform distribution across large areas. During project-level planning, consider the following guidelines for large-snag retention: ▪ In westside mixed conifer and ponderosa pine types, four of the largest snags per acre. ▪ In the red fir forest type, six of the largest snags per acre. ▪ In eastside pine and eastside mixed conifer forest types, three of the largest snags per acre. ▪ In westside hardwood ecosystems, four of the largest snags per acre (hardwood or conifer). ▪ Where standing live hardwood trees lack dead branches, six of the largest snags per acre to supplement wildlife needs for dead material. ▪ Use snags larger than 15 inches dbh to meet this guideline. Snags should be clumped and distributed irregularly across the treatment units. Consider leaving fewer snags strategically located in treatment areas within the WUI and DFPZs. While some snags will be lost due to hazard removal or use of prescribed fire, consider these potential losses during project planning to achieve desired snag retention levels.
			Spotted owl surveys
			Prior to undertaking vegetation treatments in spotted owl habitat having unknown occupancy, conduct surveys in compliance with the Pacific Southwest Region survey direction and protocols, and designate PACs where appropriate according to survey results.

Appendix B-1: Modeling Outputs and Effects

B-1.1. Introduction

Essentially the same modeling and analysis systems used in the FEIS were used for the SEIS. Therefore, this appendix will only describe items that were different from those used to produce the Final EIS for SNFPA and the reader can find a more detail description of the techniques and assumptions in Appendix B of the FEIS. This analysis, like that used in FEIS, was based on a multi-scale and hierarchical modeling approach to analyze the various alternatives developed by the interdisciplinary team. This analysis differs from the FEIS, in that it was supplemented by 2 large-scale landscape analyses to test a number of assumptions at scales smaller than the National Forest.

The analysis was accomplished by using a suite of different GIS, optimization, visualization, and simulation models to project how the national forests within the Sierra Nevada Framework region would respond to different disturbances and management events. Due to the complexity and magnitude of this project, the use of multiple models and development of a decision support system was required to integrate these processes.

The analysis uses data from forest inventory plots, GIS-based resource inventories, vegetative simulation models, fire simulation and effect models, operations research decision analysis techniques, and mapping and data visualization tools to support decision-making. Vegetative prescriptions, management activities, and disturbances events are assigned to specific types of land areas (allocations), and the resulting effects on forest outputs and environmental consequences including vegetation structure, wildlife suitability, and fuel conditions are evaluated.

Results from the modeling effort are only approximations of the outcomes under any given alternative. The limitations inherent in mathematical approximations of reality must be considered when analyzing the outputs and effects projected by these models. Once the EIS models were formulated, a number of sensitivity tests were made to check for validity, "reasonableness," and to make calibrations to coefficients whose development was not based on empirical data or where development of coefficients was not exactly straightforward. This was done through an iterative process involving all of the ID Team members, key management members, and those responsible for developing the component models. The models used were not intended by their developers to provide precise information, especially over the geographic scale and time frame encompassed by the SNFPA, but rather to provide indication of direction of change, estimates of the magnitude of change, and time frames surrounding such change.

The analysis process was based on close integration of GIS and forest inventory data with traditional vegetative growth and yield modeling which allowed users to:

- define spatially explicit management allocations, treatments, constraints (S&Gs), and priority units using GIS technology,
- link these management units to forest inventory information,
- simulate and evaluate hundreds of thousands of possible management activities, while tracking over 50 resource variables through time,
- provide insight on policy or management alternatives with different sets of desired future conditions and standards and guides,

- select an "optimal mix" of treatments to achieve a balance among a broad range of often conflicting management goals and desired future conditions,
- evaluate alternative management strategies using sophisticated simulation, mapping, reporting, and data visualization or rendering tools,
- links various resource data and models into an integrated system, enabling analysis of both terrestrial and aquatic ecosystems, and
- declare spatially explicit delineation where land management activities and resource protection measures will be meaningful.

The purpose of these models is to provide insight and clarify knowledge. In many cases, these approximations are fully adequate to compare alternative strategies or reject those that are not feasible or reasonable. A choice between alternatives can be made even though the models may lack the precision to describe the behavior of specific attributes of a given alternative. In other words, the models reveal relative differences between alternatives more reliably than absolute differences.

B-1.2. Changes in Analysis, Assumptions, and Input Data

The modeling effort for the SEIS is slightly different than that used in the FEIS, primarily for two reasons. First, updated information is available for use in the SEIS. This includes the following:

- Three new forest inventories were used to update the Eldorado, Tahoe, and Plumas National Forests statistics. These updates included new vegetative type maps and new FIA inventory plots used to describe the mapping units.
- Each of the national forests within the bioregion updated the Great Gray Owl, Spotted Owl, and Goshawk Protected Activity Center [PAC's] and home range core areas maps. These updates and refinement of boundaries are consistent with direction and definitions found in the ROD.
- Each of the national forests within the bioregion provided updated Wildland Urban Intermix [WUI] maps. These refinements are subject to further adjustment over time.
- Maps were updated to reflect that status of projects to be completed in the HFQLG Pilot Project Area.

Second, there have been changes in the way certain effects have been analyzed. This includes the following changes in assumptions used to model effects and consequences:

- The mapped representation of strategically placed area treatments was revised. In the FEIS, treatments were located in the upper 2/3 of slopes on south facing aspects. Treatment areas in the SEIS were modeled to more closely represent the herringbone pattern that underlies the "Finney" effect described in chapter 2. Through intensive fire and watershed analysis on Consumnes Watershed of the Eldorado National Forests and Kings River on the Sierra National Forest, it was found that pattern define in FEIS did not produce the desired outcomes and that a more efficient approach was needed from a fire fuels perspective. A pattern more evenly distributed over the landscape was found to be more efficient when model with FARSITE and FLAMMAP fire simulation models.
- The detailed watershed analysis described above was also used to update the fire effects coefficients in the region-wide models. Watershed analysis shows that units can be designed to retain fidelity to Finney strategy and avoid intersection with California spotted owl protected activity centers (PACs), except in areas where PACs are highly concentrated. These and other findings were used to develop coefficients that describe the related effects and effectiveness of different layout strategies and treatment intensities.

- Cost and Values derived from fuel treatment such as treatment cost and values derived from timber and biomass were updated to reflect current conditions.

B-1.3. Modeling of Alternatives

Estimates of effects are based on modeling using two complementary processes. First, the land allocations were mapped and an allowable range of prescriptions for each land allocation was developed with input from the project interdisciplinary team. Second, outputs from the combined prescription data and vegetation inventory were simulated through vegetative growth models to project changes in vegetation over time in a non-spatial manner. Outputs and treatments cannot be directly tied to specific acres on the ground for two reasons. First, the analysis includes the effects from future projected disturbances such as wildfire which cannot be predicted to occur on a specific acre, and second, the Forest Service planning process reserves to the project level planning the decision where and when specific acres will be treated. As a proxy for implementation, the model assigns a given level of treatments to a representative area to test whether the treatment can be accomplished within the constraints imposed by the standards and guidelines of the management alternative. If the activity can occur, the associated costs, revenues and outputs can be estimated along with changes in some components of habitat.

Potential outputs were generated by the use of scheduling models such as SPECTRUM or FELDSPAR. The table below shows generic prescriptions that are permitted on different land allocations used in this analysis. The following modeling rules apply to the table below.

- For each alternative, each land allocation has an associated prescription.
- The prescriptions are listed by number and any **lower** number prescriptions are permitted with some specific exceptions, as noted.
- A particular land area may be overlapped by several land allocations. When overlapping allocations occur, the lowest numbered prescription in all prescriptions sets applies and prescriptions with lower numbers are allowed.
- There are exceptions to this general rule where specific allocations mandate a higher level of treatment. For example, the defense zone overrides almost all other land allocations.
- Overrides only apply to code of equal to higher than the lowest code in the intersection set. If the specific area intersects an allocation with lower code than in the exception set, then the lower code applies.

Spatial modeling of the alternatives was conducted with ARC-INFO GIS software, with seamless resource and administrative layers across the Sierra Nevada region. Most of the analysis was conducted with GRID layers at a 30-meter pixel resolution. The development and meta-data documentation of the individual layers used for alternative modeling and consequences analysis are provided in detail in digital form in the project file as part of the planning record. A more detailed, technical description of the automated analysis process can be found in the administrative record of the FEIS. Essentially the same process was used for the SEIS.

Table B-1.3a. Maximum Permissive Prescription Modeled by Land Allocation or Zone.

Note: The Table below reflect the allocation of Prescriptions that are "PERMISSIVE" on different land allocation based on S&G's and DFC's or Intents. The prescription are code in a hierarchly manner to represent the most intensive Rx permitted on given acre of lands. Prescription with codes which are less are also permitted. Therefore, Rx's can cascade down to less intensive but not up to more intensive for a give land allocation or condition.

Data Layers, Grids, Coverages, etc.		**S2-PROPOSAL**							**S1-ROD**						
		HFQLG GRP SEL	HFQLG DFPZ	DEFENSE ZONE	TREAT ZONE SPLAT	WILDLAND SPLAT	AREA TREAT	Others	HFQLG GRP SEL	HFQLG DFPZ	DEFENSE ZONE	TREAT ZONE SPLAT	WILDLAND SPLAT	AREA TREAT	Others
Basic Treatment Zones								99							99
Group Selection [HFQLG ONLY]	int	75							75						
DFPZ's	int		71							40					
Defense Zone -WUI	int			73							50				
SPLAT's															
Threat Zone	int				63							40			
Wildlands	int					63							40		
Area Treatments															
Area Treatments	int						51							N/A	
Vegetative Type-Condition															
Non-Forested Types	=	n/a	01	01	01	01	01	01	01	01	01	01	01	01	01
Grasses	=	n/a	01	01	01	01	01	01	01	01	01	01	01	01	01
Plantations	=	n/a	15	15	15	15	15	15	01	15	15	15	15	15	15
Brush-Shrubs & slopes <=35%	=	n/a	17	17	17	17	17	17	01	17	17	17	17	17	17
Brush-Shrubs & slopes >35%		n/a	16	16	16	16	16	16	01	16	16	16	16	16	16
Eastside Pine Type and CWHR 4m,4d,5m,5d, or 6	=				65	65	65	65							
CWHR's in other than Eastside Pine	=														
4m cc 40-50%	=									27		27	27	27	27
4m cc 50-60%	=				61	61	61	61		27		27	27	27	27
4d	=									40		40	40	40	40
5m cc 40-50%	=									27		27	27	27	27
5m cc 50-60%	=									27		27	27	27	27
5d, 6	=				61					30		30	30	30	30
Other cwhr [1,2,.3, all dennsity & 4,5 p & s]	=							41		50		50	50	50	50
Residual															
Already Treated Lands to Fuel Standards	=	n/a	09	09	09	09	09	09	01	09	09	09	09	09	09
Classified Areas [in preemptive order]															
Administrative - Ownership - Not FS	min	01	01	01	01	01	01	01	01	01	01	01	01	01	01
Withdrawn: existing and Proposed, SIA, RNA, etc	min	01	01	01	01	01	01	01	01	01	01	01	01	01	01
Off-Base and Deferred Lands -HFQLG	min	01	01				01	01	01	01				01	01
Northwest Forest Plan [Lassen-Modoc]	min	01	01	01	01	01	01	01	01	01	01	01	01	01	01
Urban Core Areas -related to Defense Zone	min	01	01	01	01	01	01	01	01	01	01	01	01	01	01
Wild and Scenic Rivers	min	25	25	25	25	25	25	25	25	25	25	25	25	25	25
PACs and HRCAs in preemptive order															
Great Gray Owl - 50-ac	min	n/a	01	33	33	25	25	25	01	01	40	25	25	25	25
Spotted Owls - 300-ac dense (>5 within HR)	min	n/a	01	33	33	25	25	25	01	01	40	25	25	25	25
Spotted Owls - 300-ac spead out	min	n/a	01	01	01	01	01	01	01	01	01	01	01	01	01
Goshawks- 200-ac	min	n/a	01	33	33	25	25	25	00	01	40	25	25	25	25
Spotted owl Nest site - 500ft/18ac	min	n/a	01	23	23	23	23	23	01	01	23	23	23	23	23
Home Range Core Area for Spotted Owls	min				61	61	61	61							
Southern Fisher Conservation Area	min												23	23	23
Willow Flycatchers - occupied	min	01	01	01	01	01	01	01	01	01	01	01	01	01	01
Amphibian	min	01	01	01	01	01	01	01	01	01	01	01	01	01	01
Old Forest Emphasis Areas	min				61		43	43					25	25	25
Riparian Area - Perennials-Intermediate only															
SAT- Buffers minus empherial - HFQLG ONLY	min	01	01				01	01	01	01				01	01
Slope Break															
Greater than 35-% slope &Insuff. Vol.	min	01	25	25	25	25	25	25	25	25	25	25	25	25	25
Cost-offset Area															
Upper 2/3 Slope-Sand W Aspect	min				51	51									
Unassigned forested lands *[default]*		99	99	99	99	99	99	99	99	99	99	99	99	99	99

int	initial assignment of Rx based on DFC for Treatment Unit without constraints
=	reassignment of Rx based on it vegetative condition rather than allocation, S&G, or DFC
min	reassignment based on the most restrictive Rx or lowest number

NOTE: Treatment Allocations or Units are in pre-emptive order to prevent double counting GS trumps DFPZ's which Trumps DF which trumps TS which Trumps WS which Trumps AT for both Altn S1 and S2

Table B-1.3b. Summary of Prescription used to Model S-1 Rod and S-2 Proposal.

Summary Specification of Prescription used to model the ROD and the PROPOSAL			
	RxCode	RxName	Description
No Treatment			
	Rx-01	LetGrw	Let Grow - No Treatments planned
	Rx-02	Lethal	Disturbance Model by FVS - Lethal Burn over 2/3 BA removed
	Rx-04	MixLth	Disturbance Model by FVS - MixedLethal Burn over 1/3 and less 2/3 BA removed
	Rx-06	NonLth	Disturbance Model by FVS - Non-Lethal Burn less than 1/3 BA removed
	Rx-07	Wildld	Wildfland Fire Use
	Rx-09	PreTrt	Already treated - sent to Rx for removal of surface fuels only - follow-up
Specialized Rx's [not modeled]			
	Rx-11	system	Incidental Removal including road construction
	Rx-12	system	Restoration of Species [I.e. Aspen]
	Rx-13	system	Reforestation
Specialized Rx for Unique Forest types and/or conditions -			
	Rx-14	NonCom	Treat as Plantation to age 50/50ft ave height- Convert to fuels only treatments
	Rx-15	ComThn	Thin in plantation and treated of non-stocked forest lands
	Rx-16	Br-Fire	Fire-Brush and Shrubs
	Rx-17	BrMech	Mech-Brush and Shrubs
	Rx-18	HwFire	Fire-Woodland-Hardwood types [live oaks]
	Rx-19	HwMech	Mech-Woodland-Hardwood types [live oaks]
Fuel Reduction by Rx Fire and Hand Treatments			
	Rx-21	Unburn	Ecological purpose
	Rx-23	HandTr	Hand Treatment Required - RxFire is Not option - for nesting and den site protection
	Rx-25	RxFire	Prescribed Burning Only
	Summary of Prescription unique to the ROD only		
Fuel Reduction and Thinning			
	Rx-27	Hndtr2	6-inch Diameter Rule - No Mech - Rx Fire maybe subsituted
	Rx-30	ltfuel	12-inch DBH, 10% Canopy reduction, 50% retention
	Rx-40	ctfuel	20-inch DBH, 20% Canopy reduction, 50% retention
	Rx-48	mltprd	30-inch DBH, no- Canopy reduction, no- Canopy retention
	Rx-50	dfpzfb	30-inch DBH, no- Canopy reduction, no- Canopy retention
Salvage			
	Rx-101	system	Limited Salvage - dead only
	Summary of Prescriptions under the Proposal only		
Fuel Reduction and Thinning			
all start Rx's always done a basic MechT1 or MechT2 treatment before considering constraints or moving to other objectives			
	Rx-31	MechT1	Mech. Treatment - Surface and Ladder Fuels only
	Rx-33	MechT2	Mech. Treatment - Surface, Ladder, and Crown Fuels only
	Rx-35	ForHlt	Mech. Treatment - Surface, Ladder, and Crown Fuels + Forest Health - Drought resistance
	Rx-41	OthThn	Mech. Treatment - Meets Fuels and Health applies to other CWHR classes - non habitat
	Rx-43	OldFor	Pre-Mech. Treatment followed by RxFire - Meets old forest structure obj. - Meets 50% canopy
	Rx-51	MaTbr1	Mech. Treatment - Meets Fuels and Health + sufficient volume to meet operability thresholds
	Rx-55	2Stord	Mech. Treatment - Meets Fuels and Health + sufficient volume & two storied stands
	Rx-61	MaThn1	Mech. Treatment - up to S&G's - 40/50-Goals treated as standard
	Rx-63	MaThn2	Mech. Treatment - up to S&G's - 40/40
	Rx-65	MaThn3	Mech. Treatment - Meets fuels and Health - Eastside Pine [4m-6] & HFQLG DFPZ's
	Rx-67	MaThn4	Mech. Treatment - Meets Fuels DFC's and HFQLG's desires -ALTERNATE
	Rx-71	Caspo2	Modified CASPO for HFQLG [based in Interim Guidelines] - Select 40%, others 30% BA retention
	Rx-73	DefZon	Defense Zone Fuels and Revenue
	Rx-75	Gap-30	Thin up or remove to 30-inch - GAP Regen [includes HFQLG version of Group Selection]
Timber Products			
	used only on lands declared suitable for timber management - e.g. BVFSYU- Modoc NF		
	Rx-81	GrpSel	Group Selection in units less 2.5-acres - manage by units
	Rx-83	MatxGS	Matrix Group Selection were unit are inclusions
	Rx-85	GrnTre	Green Tree Retention
	Rx-87	Shltwd	Standard Shelterwood Harvest [prep, seed,and removal stages]
	Rx-88	Adv-CC	Clear cutting with advanced regeneration
	Rx-89	CCType	Clearcutting and Type conversion.
Salvage			
	Rx-103	system	Limited Salvage dead and dying
	Rx-105	system	Salvage up limits defined by S&G's in units > 10-acres

B-1.4. Overview of Scheduling Model Process

After the land allocation maps were completed for each alternative, analysis areas were developed based on:

1. vegetative types,
2. management areas or zones which define where activities are permitted, modified, or restricted,
3. constraints and/or desired conditions that constrain activities, and
4. other terrain or management designations where the same activity under the same prescription can be expected to produce significantly different output or where the full range of biologically possible management actions may not be appropriate.

Acres in each unique analysis area are assumed to respond in the same way to management activities and produce the same outputs and effects regardless of their location on the forest. This process allows the user to formulate and re-formulate alternative sets of management goals and desired resource conditions by creating new Analysis Areas, new management objectives, and new standards and guidelines.

All of the alternatives have several management areas where different management direction applies. The *land allocation* defines which activities are allowed, need to be modified, or are prohibited. The *standards and guidelines* define the limits or requirements that must be met before any activities occur. The o*bjectives* are usually defined as the set of desired conditions to be attained from carrying out the activities. The objectives provide a means of selecting which treatments should occur from the suite of option allowed in a given land allocation. In addition, for some of the alternatives, management direction includes *prioritization* of treatments depending upon spatial patterns, existing conditions of wildlife habitat, vegetation, fuel hazard or fire risk. When conflicts occur, land allocations override standards and guidelines which override objectives which override priorities. A summary of the names of the individual layers used in modeling alternatives and analyzing consequences, and the sources of the data for them, is provided in the following table. For complete documentation of the individual layers, see the GIS data documentation CD used for FEIS.

Forest inventory data are then linked to each strata type. The Region 5 Forest Service Forest Inventory and Analysis (FIA) inventories and databases provided sampling data to describe the various map strata. Data associated with a stratum type includes a tree list of species, dbh, height, live-crown ratio, tree sampling weight, etc. and plot location information. This data is the input used in the GAMMA forest vegetative simulators based on coefficients from Forest Service Forest Vegetation Simulator (FVS) model (formerly known as PROGNOSIS). The growth simulators represent the growth of FIA plots and the effects on tree growth stemming from application of various management treatments and disturbance (fire, insects, disease, etc.) agents over time. Data output from these simulators include yield and habitat tables that show how various attributes of the stand change from the cumulative effects of growth, treatment, and disturbance. This data also can be classified into CWHR categories and different types of specialized habitat. Over 50 variables are tracked over time by prescription. Information on regeneration success in plantations (summarized by Silvicultural Accomplishment Report), estimates of insect and disease activities based on change detection, and analysis of the last 25 years of fire history were used to develop the mortality model used in GAMMA and SPECTRUM. The Forest Service Timber Sale Program Information Reporting System (TSPIRS) and State of California Board of Equalization timber value databases were used to estimate values and costs.

A realistic growth and yield model is essential to predicting change in forest condition and assessing impacts of vegetative manipulation. There are numerous growth and yield models used to project forest growth and mortality. For this planning effort, we used the GAMMA model developed by Wilson, (1999) which is a variation of Forest Service FVS model. GAMMA uses the FVS growth coefficients but manages the data and prescription scripts, or key words, differently. The GAMMA simulator permits the user to track inventory, growth, mortality, and removal through time. The GAMMA visual basic programming language options also permits the tracking of derived variables such as habitat components, snags, dead and down, etc. GAMMA is an individual tree growth and yield model for Sierra Nevada. The simulator processes stands of trees plot-by-plot and then aggregates the results as strata averages at end of each time period. Prescription "scripts" are developed to simulate management through time. These strata-prescription regimes are written to simulate how vegetative manipulation could occur in these types. The simulator uses forest inventory [FIA] plots data as input. The tree lists from inventory plots for each vegetation strata are run separately to develop yield streams particular to each vegetation strata. The results are stored in relational database for used by other programs. The GAMMA model defines the range of biologically feasible activities that can be considered as management options throughout the planning process.

B-1.5. SPECTRUM Analysis

The linear programming (LP) model SPECTRUM (formerly known as FORPLAN) developed by K. Norman Johnson was selected as the primary analysis tool for National Forest scale planning. SPECTRUM is used to analyze different management alternatives. It optimizes the attainment of desired future conditions (DFCs) by scheduling activities that move existing conditions toward the desired future conditions. The scheduling process is influenced by standards and guidelines imposed disturbance regimes, and the projected outputs and effects of time as a result of implementing the alternative. The major strength of this model is its ability to model the effects of constraints on outputs over time. The major limitations of this model, as related to this project, are that activities and projected effects are not spatially explicit (activities area assigned to AA's and not specific acres) and that inputs and outputs are deterministic (do not consider variability and uncertainty in input data).

SPECTRUM was used to determine the most cost effective schedule of treatments that would produce desirable outputs and effects given the objectives (DFCs) and the constraints (standards and guidelines) for each alternative. The interdisciplinary team provided a range of management alternatives. A SPECTRUM analysis was then made for each alternative and each National Forest within the SNFP region. All the information needed for SPECTRUM analysis was entered into a set of data files. The SPECTRUM matrix generator then created a matrix of rows and columns that is then solved by linear programming software. A report is then generated that is used by the interdisciplinary team to analyze the environmental consequences of the alternatives. Reports can be made for the entire planning area or for individual attributes defining the analysis areas or management prescriptions.

The interdisciplinary team specified which set or suite of prescriptions would be allowed on each acre of land by alternative. The development of these specifications has been described above. This specification was used in SPECTRUM to limit the kind of activities that could occur within a specific land allocation within a specific alternative. Each numerical code was placed in a hierarchy wherein activities represented by lesser numbers were allowed, but activities with greater numbers were not. This assignment was mapped and overlaid with vegetative strata and other layers to form unique analysis areas within the SPECTRUM model for each alternative.

Constraints are parameters added to the linear programming model that limit the means of optimizing goals as represented by the objective function. An example of constraint would be to limit the total amount of initial treatment to less than 120,000 per year for all alternatives analyzed. In many cases these constraints are imbedded in the yield and wildlife habitat tables (such as limits on canopy cover reduction).

A number of different output reports can be generated from the SPECTRUM system. The bulk of the report contains information on scheduling of activities, the amount of outputs and effects produced by these activities, and financial costs and values produced. Examples of items reported include: acres of mortality by different severity classes, volume of timber removed by various products, acres of the forest in various CWHR classes, costs of different management activities, and the inventory, growth/mortality, and removal of various stand attributes such as snags, dead and down material, and large trees.

B-1.6. The "CWHR" System

The University of California, Berkeley, and the California Department of Fish and Game developed the California Wildlife Habitat Relationships System (CWHR) (Airola 1988, Mayer and Laudenslayer 1988, Zeiner et al. 1990) CWHR system cooperatively. It contains information relating the habitat preferences of 643 terrestrial vertebrate species found in California. It allows a user to predict the occurrence and habitat quality for any of these species based upon the presence of specific habitat types and habitat elements. It includes species notes for each species including life history, range maps, legal status, habitat requirements, etc. In addition, it contains ARC/INFO GRID habitat suitability models for more than 30 species, a dBase compatible database and data-query system, and a series of books describing the system. The WHR habitat system, like many other vegetation classification systems, uses the combination of plant species, size, and density to classify habitats. The CWHR system then uses this habitat classification to identify habitat relationships between the vegetation found in an area and wildlife which is likely to be found in that area.

WHR habitat classification predictions are incorporated into GAMMA vegetative growth and yield model, allowing the prediction of habitat changes over time associated with different vegetative and silvicultural regimes. Tying these habitat predictions back to the wildlife species database provides one basis for determining how planned forest management activities are likely to influence wildlife populations in the future. This information can then be used to evaluate whether or not a given mix of management activities are likely to meet a specific set of desired conditions related to wildlife habitat.

Experience has shown that many critical or important wildlife habitats should be modeled with a specific habitat model rather than trying to crosswalk a generalized model, such as CWHR, to predict those habitats. Therefore, species such as California spotted owl, goshawk, key fur bearers, etc. uses models and classification systems based upon documented habitat use and local observations instead of trying to use CWHR to understand forest management implications. Where possible, a "chain of evidence" approach leads to better habitat models. This method uses several different ecosystem and vegetative characteristics to identify habitat.

Figure B-1.6a. Chart of CWHR Classes.

CWHR HABITAT STAGES			YOUNG				MATURE		
			size class 0	size class 1	size class 2	size class 3	size class 4	size class 5	size class 6
			non-stocked	seedling	sapling	poles	small tree	large tree	multi-canopy
				<1-in DBH	1-5.9"-DBH	6-10.9"-DBH	11"-23.9"-DBH	>23.9"-DBH	size 5 over understory
OPEN	no cover	<10% canopy cover	**non-stocked**	**stocked**					
OPEN	sparse cover (S)	10-24% canopy cover		1x	2S	3S	4S	5S	
OPEN	open cover (P)	25-39% canopy cover			2P	3P	4P	5P	
CLOSED	moderate cover (M)	40-59% canopy cover			2M	3P	4M	5M	
CLOSED	dense cover (D)	60-100% canopy cover			2D	3D	4D	5D	6

B-1.7. Modeling Disturbance from Wildfire, Insects, and other Pests

The purpose of disturbance prescriptions is to model disturbance and recovery from wildfire. To simulate fire, the tree-killing algorithms in the First Order Fire Effects Model (FOFEM) are used. The factors that affect tree mortality in FOFEM include scorch height and bark thickness. Gamma calculates a scorch height based on user-supplied flame-length. Bark thickness is calculated using Region 5 species-specific equations found in the Wessin, Sornec, and Icasca variants of the Forest Vegetation Simulator source code. Three conditions of fire severity, with associated recovery options, are modeled in the internal disturbance prescriptions lethal fire, mixed lethal fire, and non-lethal fire. Each of these are described in appendix B of the FEIS.

B-1.8. Canopy Cover Modeling using Plot Data

Tree crown cover is the ground area covered by a tree crown, as delimited by the vertical projection of its outermost perimeter. The aggregate expression of crown cover is canopy density, or canopy cover.

Canopy cover (expressed as a percent of area) is being afforded ever-increasing importance in terms of evaluating and classifying forest stands and in defining or setting parameters for stand treatments. Values for percent cover come from many sources; from photo-interpretation using the Li-Strahler model, from densiometer measurements in conjunction with wildlife habitat studies, from inventory data processing. There has been some concern over a period of time that percent cover values from these sources are being used interchangeably, without considering that these 3 approaches may result in widely, even wildly divergent values for percent cover.

Analysis for this SEIS is based on a calculation method using field measurement of tree diameter called PcNetAvg, with one exception. If the standards and guidelines required that canopy cover be measured by Photo Interpretation [PI], then a regression equation based on related plot and PI collected over the last 10-years in the region was used to convert to that scale. Percent cover is a component of the CWHR and LSOG habitat classification systems and is used to constrain tree removal in various thinning prescriptions.

John B. Collins and Curtis E. Woodcock compared percent cover values developed from photo-interpretation with values determined by processing forest inventory data (Collins, J.B. and Woodcock, C.E. Revising Estimates of Canopy Cover Derived from the Li-Strahler Model. Tech. Pap. No. 12. Boston University Center for Remote Sensing). To obtain estimated percent cover from field data, they used techniques analogous to those found in "How to estimate canopy cover using maximum crown width/dbh relationships" by Ralph Warbington and Jack Levitan for "non-overlapping" cover. First, the proportion of land covered by tree crowns is calculated based on dbh-crown width relationships (call this "gross" cover). Then the gross cover values are adjusted for crown overlap, assuming trees are randomly located:

Random Cover = (1 - 1/EXP (Gross Cover)) * 100

Where Gross Cover is the sum of individual tree crown area's (or mean tree crown area times number of trees) divided by 43560. This formulation has the desirable property of limiting percent cover estimates to less than 100%. Gross Cover for stands quite often exceeds 100%. The correction equation is:

Adjusted Cover = -0.0319 + 1.151 * Random Cover

In other words, percent cover values derived from photo-interpretation are about 15% higher than corresponding estimates derived from inventory data processing, assuming random tree spacing.

Gamma, an application developed for the Sierra Nevada Framework growth & yield analysis, uses a procedure named pcNetAvg to adjust Gross Cover to percent cover values used for habitat classification and for stand treatments which are defined, in part, by residual percent cover requirements. It calculates a weighted average between Random Cover and Gross Cover, and then averages the intermediate value with Random Cover. pcNetAvg values do not exceed 100% for any feasible values of Gross Cover.

B-1.9. Outputs, Effects, and Products generated by the Analysis over the Planning Horizon

1. ***SWTB*** - **MBF** Scribner, for all commercial conifers >= 9.9" dbh to 6-inch top (that would exclude species like juniper, bristlecone pine, etc. ... Net volume (minus defect) is determined using Levitan average defect equations.
2. ***BIOM*** - **BDT's -** calculate total stem cuft volume for all live trees, convert to **BDT's**
3. ***FUEL*** - slash and ground fuels, including litterfall and limbs. under development... cuft of down material **< 3.0**" diam, converted to **BDT**... for the grid inventories I can initialize point-by-point from woody debris inventory, for other inventories (Tahoe and plantations), we'll have to make a estimate.... amount at any point in time is result of initial value minus decay plus input from treatment or snag/limb fall... I can borrow much of this from FFE.
4. ***D&DW*** **-** cu ft of all dead material (standing and down) > 3.0"; initialize from inventory, level based on interaction of decay rate and new mortality -- reduced during treatment or fire by specified percentage...Proposed methodology is: for trees with dbh > 3.0", for larger material calculate a cone segment from lg diam = dbh to sm diam = 10", assuming taper is 1" in 8 feet... this will be approximate wood volume (not including bark).. then convert to **BDT**.

5. ***%COV*** - **Percent canopy cover** using regressed value to represent PI crown cover consistent with the mapping and plot work described above.
6. ***SNAG*** - **number of standing snags** > 15" dbh and minimum height of 20-ft; initial levels from inventories, level at any period is balance of snag fall predicted by exponential decay model (with half-life specified by species and/or dbh classes) and new mortality.
7. ***HDWD*** - **number of hardwood trees** > 15" dbh
8. ***LGTR*** - **number of large trees --** minimum dbh is 30" westside, 24" eastside, 21" in alpine types (A and L)
9. ***VLTR***v **number of very large trees** -- minimum dbh is 50" westside, 40" eastside, 32" alpine
10. **CWHR -** 15 categories in 3 age dependent tables, same as draft except calculation method slightly modified... still uses pcNetAvg for percent cover [same as in the draft]. Measured in **acres.**
11. ***RANK*** - SNEP Old growth ranks 1-5 [same as in the draft] Measured in **acres.**

B-1.10. Contrast between Alternative S1 and Alternative S2

The primary differences in the modeled prescriptions [series of activities over time designed to meet a desired condition or objective] for Alternative S1 and Alternative S2 are described below.

1. Absolute upper diameter limits in Alternative S1 [6-inch, 12-inch, and 20-inch limits] are replaced with variable diameters limits in Alternative S2. These limits are based on retaining either 30 or 40 percent of the existing basal area in the largest trees. The 30-inch DBH maximum rule is retained. In most cases, except for previously thinned stands, the basal area retention rule will lead to lower limits than the 30-inch maximum. The Gamma model is used to calculate these diameter limits.
2. Under Alternative S1, canopy cover limits are considered absolute and treatments cannot bring the stand below these values even if the stand existing condition is at the "cusp" and a minimum desired fuel treatment would bring the stand below this standard. Under Alternative S2, fuels treatments are allowed in all cases, even the removal of ladder fuels would technically bring a stand below the canopy standard. This difference is significant because a large number of the acres to be treated are at the 40-50-percent canopy class and under Alternative S1, have a high probability of not being able to receive an adequate fuel treatment because of the canopy standards and guides.
3. Alternative S1 does not allow trees greater than 6-inches to be removed if the stand has a canopy cover of 40 to 49.9 percent and if mechanical means are to be used. Trees with diameter less than 6-inches are allowed to be harvested. The reason for this exception is that stems less than 6-inch do not count in the determination of canopy closure.
4. Alternative S1 requires approximately 20 percent of a stand [it ranges from 10-25 percent, depending on land allocation] to be left untreated if mechanical treatment is to be used. The result is fewer effective acres of treatment.
5. Alternative S1 and Alternative S2 apply the standards to different scales. Alternative S1 applies its standard and guidelines to individual stands while the standards and guidelines of Alternative S2 usually apply to stand aggregates within a treatment unit.
6. Only Alternative S1 requires the identification 1-acre inclusions of CWHR 5M, 5D, and 6 and assigns them a more restrictive set of standards. .

Just as there are significant differences between the alternatives, there are key similarities between them including the following:

1. **Alternative S1 and S2 use the same land allocations including the same treatment units over the next 20-years with two minor exceptions.** This explains why the treatment schedules and many of the effects are quite close when comparing Alternative S1 to Alternative S2. There are two notable exceptions: First there is the difference in the acres of group selection expected to occur in the HFQLG Pilot Project Area. Second there is some difference in the way treatments in PACs are controlled and modeled (see chapter 4 for more details).
2. Both alternatives use the same logic to assign which acres will receive a prescribed burn and which are candidates for mechanical treatment.
3. Neither alternative pushes the its treatment units to the maximum amount of product that could be produced, instead incorporating the desired condition in the prescriptions assigned to the land allocations. This means for the purpose of this analysis, the defense zone prescriptions did not remove all stems up to 30-inches. Rather, the prescription was limited to only remove the stems needed to alter fuels to meet a desired fuel condition for the zone. Both alternatives optimize at landscape rather than at stand level as related to selection of prescription to be used.

In summary, what distinguishes the alternatives from each other is the intensity of the activities that can occur in each of the treatment units. This directly affects the economic efficiency of the overall program and the number of acres that can actually be accomplished for a given funding level. the location of the treatment units is modeled the same for both alternatives.

B-1.11. Modeling Assumptions [General]

1. The proposed action to be analyzed is approximate 2.2 to 2.3 million acres vegetative treatments on 14 National Forest Units within the next 20-years for the purpose of fuels reduction and forest health. Each unit was analyzed separately with its own schedules.
2. The maximum “average” effectiveness of treatment was assumed to be 20-years; thereby requiring maintenance treatment at that time to maintain these acres in a desired fuel condition.
3. For all non-QLG forest units, GSNM, and BVFSYU, equal number of acres of treatment are assumed to occur annual for each plan period. Of the treatments, 50% are assumed to occur in the WUI in the first period until all the acres are utilized or like the Modoc where there are insufficient WUI treatment acres to meet the 50% of the program. For each acre of defense zone treated, 2-4 acres of threat zone area treatments were required to occur. This assured that the WUI get the desired mix of defense and threat zone treatment needed to reduce fire effects on the landscape.
4. The HFQLG Pilot Project is assumed to be completed by the end of calendar year 2009. It is then given the first priority for any Region-wide standards and guidelines that may constrain overall program activity, such as the 5-10% PAC entry rule. DFPZs will be maintained. After 2009, activities in the HFQLG Pilot Project Area are modeled under the rules applicable to the rest of the national forest lands in the bioregion.
5. It is assumed that 80% of the initial treatments related to fuels will require a “follow-up” treatment to get surface fuels to desired treatments. This is planned to occur with 2-4 years after initial treatment. It is also assumed that 80% of the follow-up treatments will need addition work with about 10-years. A 20-year maintenance cycle is then assumed. It is recognized that there will be large variance depending on local condition and this rule is only set up for the convenience of modeling effects and projecting cost. The majority of this work is assumed to be by prescribed

fire. For the purpose of modeling, if the initial treatment was fire, the follow-up is fire. If the initial treatment was mechanical-hand, it is assumed that 40% would be mechanical and 60% fire.

6. Plantations are treated as separate unit or allocation. It is assumed that the required release and pre-commercial thin would occur to maintain them. They are only subject the 30-inch maximum trees size removal rule and the prescription assigned to them would be a function of their condition and whether there was sufficient volume to cover a commercial removal.

B-1.12. Qualifications of Planning Team Analysts

The planning analysts for this project included Klaus Barber, Bernie Bahro, Andy Taylor, and Ken Wright. Each has over 15-years experience in the field. Together they have presented over 50 technical papers related to the kind of analysis described below, and all are considered experts in their fields. All have experience with Forest Plans, the FEMAT report and Northwest Forest Plan, and the revised draft environmental impact statement (RDEIS) for Managing the California Spotted Owl. Allocation mapping was accomplished by a team led by Dr. Joanne Fites-Kaufman, a forest ecologist with more than 10 years experience. Dr. Fites-Kaufman was also a principal scientist for the Sierra Nevada Ecosystem Project. All the analysts were supported by the interdisciplinary team in the development, testing, and deployment of the models.

Appendix B-2: Summary of Prescriptions Used to Model the Alternatives

Vegetative Simulator or Model: Gamma3 [Wilson, 2003] based on Forest Service Forest Vegetative Simulator and Variants was used to model vegetative effects from treatments and disturbances. The rules defined here are for the purpose of modeling effects and are subject to changes based on local conditions. In modeling the modal or most likely condition [rather than maximum or minimum] was used when the standards and guides allow for a range of conditions.

Treatment: is an activity done to a stand or stratum at a single point in time, e.g., burn treatment, habitat thin, DFPZ thinning, and lethal mortality.

Prescription: A series of treatments, follow-up treatments, in growth, etc. over a period of time. The year of the first scheduled treatment is set in Gamma, and from then on the treatment schedule is embedded in the prescription logic. Many prescriptions branch to different treatment sequences depending on strata label or stand conditions.

No Treatment Prescriptions

Rx –01: LetGrw: No treatments planned, the stands are allowed to grow and only subject to natural disturbance events.

Disturbance Events Modeled as Treatments

DE-02: Lethal or Stand Replacement Fire-Mortality: Over 2/3 of the basal area has been killed.

DE-04: Mixed-Lethal Fire-Mortality: Between 1/3 and 2/3 of the basal area has been killed.

DE-06: Non-Lethal Fire-Mortality: Less than 1/3 of the basal area has been killed.

Logic: Fire kills trees per FOFEM predicted mortality, reduces crown due to scorch to midway between original crown base and point of scorch height.

Parameters:

- flame length: feet (converts internally to scorch height)
- mort multiplier: modify FOFEM predictions
- percent area: area reduction factor, percent of area treated, applied uniformly

Specialized Prescription for special circumstances and not limited by Standards and Guides. Evaluated at the project level

Rx –07: WldFir: Wildland Fire Use is model the same as 80% non-lethal and 20% mixed lethal wildfire. Can only be used if an approved Fire Plan exists for the area. This is an form of area treatment.

Rx –09: Treated: Land has already been treated to the desired condition and no treatment is need in the planned period or only a follow-up treatment is needed.

Rx –11: xxxxxx: Incidental removal including road construction and removal for facility development. Decision is deferred to the project.

Rx –12: xxxxxx: Restoration of tree species such as Aspen, Riparian Hardwood, etc. Not subject to basal area retention, diameter, or canopy cover requirements. Decision is deferred to the project.

Rx –13: xxxxxx: Reforestation

Specialized Prescription for unique forest types or conditions and not subject to the general standards and guides related to integrated vegetative treatments

Rx –15: ComThn: Plantations and non-stocked lands on commercial capable and available forested lands. Follows the Framework standards and provides for release, pre-commercial thin, and commercial thins based on basal area targets [thin down to 55% of normal and produce a yield of 2.5-mbf/acre to be considered commerical]. Only binding constrain is 30-inch diameter limit on maximum size tree that can be removed.

Rx –16 and 17: Br-Shr: Fuel treatment prescription for Shrubs and Brush types. A mosaic burn is usually assumed were about 70-80% of the areas get converted to a younger age. Not modeled by FVS-Gamma.

Rx –18 and 19: Hrdwod: Fuel treatment for woodland [mainly live oak] type. Most Black oak –conifer type is subject to the same treatments as mature conifers. When mechanical treatments are used, no blue oaks over 8-inch and no other hardwood over 12-inch can be removed. Prescribed fire is the most common method used here.

Rx-20's: Fuel Treatment with minimum impact on the landscape based on hand treatments and prescribed burning

Rx –21: Unburn: Light prescribed fire based on an underburn with 2-ft flame length. This Rx is not used for meeting fuel objectives but rather returning fire to the ecosystem. No follow-up burn is modeled.

Rx –23: HandTr: Hand Treatment of material less than 6-inch followed by an underburn based on a 2-ft flame length with 3-years were hand treatments are the only permissible choice.. In most dense stands, this Rx does not convert the stand to desired fuel conditions because insufficient ladder and/or crown fuels are removed. This is Hand Treatment only.

Rx –25: RxFire: Use of prescribed fire to meet surface, ladder, and canopy fuel requirement or conditions. This treatment is followed by an underburn of 2-ft flame length with 5-years.

Rx –27: HndTr2: Hand Treatment of material less than 6-inch followed by an underburn based on a 2-ft flame length with 3-years. In most dense stands, this Rx does not convert the stand to desired fuel conditions because insufficient ladder and/or crown fuels are removed. Rx Fire is defined as a default Rx.

Fuel treatments in the 30-60's series are all based on the concept of doing a basic surface, and ladder and in some case canopy fuel treatment defined by prescription MechT1 [Area treatments] and MechT2 [fuelbreaks, DFPZs, and Defense Zones] first and then doing additional removals to meet other objectives. The basic treatments are done independent of any canopy closure requirements.

Rx-30's: Mechanical Fuel Treatment that remove ladder and canopy fuel similar that which would occur if a burn were to occur:

Logic: Mechanical treatment are model similar to Fire kills trees per FOFEM predicted mortality except no crown reduction.

Parameters:

- flame length: feet (converts internally to scorch height)
- mort multipler: modify FOFEM predictions
- percent area: area reduction factor, percent of area treated, applied uniformly
- max diameter: Limits the maximum size of tree that can be thinned

Logic: Ladder Fuel removes trees with crown base below threshold to a target basal area, subject to general canopy closure and dbh constraints, and additional species specific constraints as follows:

1. no GS removed
2. no sugar pine > 6" removed
3. no blue oak > 8" removed
4. no hardwoods > 12" removed

Rx –31: MechT1: This is the basic mechanical fuel treatment that is a proxy for surface and ladder fuel removal only and is used when canopy reduction is to be minimized but still have an effective fuel treatment. All the Rx's in the 30-60 series use this or MechT2 as their starting point. This Rx is **always permitted** if fuel treatments are required on a given acre. Constraints are tested for after this basic treatment has occurred. The trees to be removed are similar to those that would be killed if a fire were to occur based on 5-ft flame length as a proxy for removing minimum trees needed to meet surface and ladder fuels. There is a 20-inch diameter limit. This treatment would be followed up with an underburn or mechanical treatment based on a 2-ft flame length on using a 50% effectiveness factor. This Rx was developed for use in the SPLATs where the treatments are to function only as a modification of fire behavior and not as a barrier to fire.

Rx –33: MechT2: This is the basic mechanical fuel treatment that is a proxy for surface, ladder fuel, and some canopy fuel and is used when canopy reduction is to be minimized but still have an effective fuel barrier. For these types of prescriptions, this is the starting point. This Rx is **always permitted** if fuel treatments are required on a given acre. Constraints are tested for after this basic treatment has occurred. The trees to be removed are similar to those that would be killed if a fire were to occur based on 6-ft flame length as a proxy for removing minimum trees needed to meet surface and ladder fuels. There is a 24-inch diameter limit. This treatment would be followed up with an under-burn or mechanical treatment based on a 2-ft flame length on using a 50% effectiveness factor. This Rx was developed for DFPZs and Defense Zones were the treatments are to function as a barrier.

Rx –35: ForHlt: This mechanical prescription meets the Surface, Ladder, and Canopy fuel requirements and if excessive stocking still exists as measured by SDI, it further reduces the stocking until the stand is considered pest and drought resistant. The trees to be removed are similar to those that would be killed if a fire were to occur based on 7-ft flame length as a proxy for removing minimum trees needed to meet surface and ladder fuels. There is a 30-inch diameter limit. This treatment would be followed up with an under-burn or mechanical treatment based on a 2-ft flame length on using a 50% effectiveness factor. This Rx was developed for stands with excessive SDI's for forest type and site class and reduction is stand density is deemed necessary.

Rx-40's: Mechanical Fuel Treatment that apply to non spotted owl Habitats [NOT CWHR types 4m,4d,5m,5d, or 6]

Rx –41: OthThn: Fuel Thinning designed for CWHR size classes 2 and 3, all canopy density and size class 4 and 5 with canopy classes of S or P only. These stands are considered non-habitat for spotted owl. This prescription starts with a MechT1 treatment. Additional trees may by removed by thinning proportionally stems greater than 9.9-inch-dbh until one binds on only of the following constraints.

1. 30-inch DBH maximum size tree removal limit
2. 50 sq. ft. of basal area or ½ of existing basal area, whichever is larger

Rx –43: OldFor: Fuel Thinning designed for Old Forest Emphasis. Use when a mechanical treatment [MechT1] is needed to pre treatment for a stand. Once sufficient fuels have been removed to make burn safe, RxBurn at 4-ft is then used and followed up by RxFire Rx at 2-ft every 20 years. This prescription starts with a MechT1 treatment. The intent is to return to a natural fire regime using fire as tool for fuel maintenance to the extent possible. This is Rx-31 + Rx-25 combination.

1. 24-inch DBH maximum size tree removal limit
2. 50% canopy closure if it exists

Rx-50's: Mechanical Fuel Treatment that meet fuel objectives and provide some opportunities for timber sales and development of multi-storied stands short of regeneration

Rx –51: MnTbr1: This fuel treatment attempts to produce timber products at a minimum amount necessary to allow for a timber sale to occur while meeting fuel objectives. There is not an attempt to push for additional yield once the requisite volume for a sale is obtained. This prescription starts with MechT1 treatment. If the canopy closure is greater than 40% [pcNet], the stand is thinned proportionally from stem 9.9 inch until you bind on one of the following constraints.

- **3,000** board feet per acre of sawlog removal
- **5%** minimum retention in post canopy cover in stems 6-24-inches DBH [ignored in modeling since near to impossible to violate given the other rules]
- **30-inch** DBH maximum size of tree that can be removed mechanically
- **30%** maximum canopy reduction in a single treatment
- **40%** minimum BA retention in the largest trees,
- **40%** canopy closure minimum retention

Rx –55: 2Stord: Fuel thinning Rx for generating two storied stands [CWHR-6] and generating some value to off-set cost. Treatment starts with MechT1. If canopy closure after MechT1 treatment is greater than 40%, thin from above until [from the upper most diameter permitted under BA retention rule or the 30-inch rule, whichever is smaller] until one binds on one or more of the following constraints.

- **5%** minimum retention in post canopy cover in stems 6-24-inches DBH [ignored in modeling since near to impossible to violate given the other rules]
- **30-inch** DBH maximum size of tree that can be removed mechanically
- **30%** maximum canopy reduction in a single treatment
- **40%** minimum BA retention in the largest trees,
- **40%** canopy closure minimum retention

Rx-60's: Mechanical Fuel Treatment that remove ladder and canopy fuel similar that which would occur if a burn were to occur

Rx –61: MaThn1: This is universal Rx for doing the 50/50 Rule were the 50% Canopy Closure goal is invoked. Treatment starts with MechT1. If canopy closure after MechT1 treatment is greater than 50%, then thin proportionally stems greater than 9.9-inches until you bind on one of the following constraints:

- **5%** minimum retention in post canopy cover in stems 6-24-inches DBH [ignored in modeling since near to impossible to violate given the other rules]
- **30-inch** DBH maximum size of tree that can be removed mechanically
- **30%** maximum canopy reduction in a single treatment
- **40%** minimum BA retention in the largest trees,
- **50%** canopy closure minimum retention

If Canopy closure after the MechT1 is less than 50%, then

STOP

If canopy closure after MechT1 treatment is less than 50%, but greater than 40%, then thin proportionally stems greater than 9.9-inches until you bind on one of the following constraints:

- **5%** minimum retention in post canopy cover in stems 6-24-inches DBH [ignored in modeling since near to impossible to violate given the other rules]
- **30-inch** DBH maximum size of tree that can be removed mechanically
- **40%** minimum BA retention in the largest trees,
- **40%** canopy closure minimum retention
- 40% maximum canopy reduction in a single treatment

If Canopy closure after the MechT1 is less than 40%, then

STOP

Rx –63: MaThn2: This is universal Rx for doing the 50/50 Rule where the 40% Canopy Closure goal is invoked. This Rx pushes to the lower limit related to canopy. Treatment starts with MechT1. If canopy closure after MechT1 treatment is greater than 40%, then thin proportionally stems greater than 9.9-inches until you bind on one of the following constraints:

- **5%** minimum retention in post canopy cover in stems 6-24-inches DBH [ignored in modeling since near to impossible to violate given the other rules]
- **30-inch** DBH maximum size of tree that can be removed mechanically
- **30%** maximum canopy reduction in a single treatment
- **40%** minimum BA retention in the largest trees,
- **40% canopy closure minimum retention**

If Canopy closure after the MechT1 is less than 50%, then

STOP

Rx –65: MaThn3: This is universal Rx for doing Eastside Pine type only which have lower canopy closures on the average [based on the 30/30 rule]. This Rx pushes to the lower limit related to canopy. Treatment starts with MechT1. Then thin proportionally stems greater than 9.9-inches until you bind on one of the following constraints:

- **30-inch** DBH maximum size of tree that can be removed mechanically
- **30%** minimum BA retention in the largest trees,

Note: there are NO canopy requirements under this Rx.

Rx –67: MaThn4: This is a revised DFPZ Rx for used on HFQLG based on Forest desires. This Rx pushes to the limit in order to generate product and value. Treatment starts with MechT2 [for barriers]. If canopy closure after MechT2 treatment is greater than 40%, then thin proportionally stems greater than 9.9-inches until you bind on one of the following constraints:

- **30-inch** DBH maximum size of tree that can be removed mechanically
- 30% **minimum BA retention in the largest trees,**
- **40% canopy closure minimum retention**

Rx-70’s: Mechanical Fuel Treatment that remove sufficient volume to meet fuel objectives and have the capacity to generate timber products and revenue to off-set the costs of total fuels package

Rx –71: Caspo2: Mechanical Fuel Treatment based on the California Spotted Owl Interim Guide Lines for defining level of treatment that can occur. Basal area retention standards depend on Timber Strata. Selected strata are bound by three major constraints:

- **30-inch** DBH maximum size of tree that can be removed mechanically
- **40%** minimum BA retention in the largest trees,
- **40% canopy closure minimum retention**

Non selected strata are bound by only these constraints:

- **30-inch** DBH maximum size of tree that can be removed mechanically
- **30%** minimum BA retention in the largest trees,

Rx –73: DefZon: This Prescription thin to 60% of normal basal area. This is a revised Defense Zone Rx that provides some addition limits on tree removal than just limiting to 30-inch trees. This Rx pushes to the limit in order to generate product and value. Treatment starts with MechT2 [for barriers]. This is followed by thinning proportionally stems greater than 9.9-inches until you bind on one of the following constraints:

- **30-inch** DBH maximum size of tree that can be removed mechanically
- **60%** of normal basal for the type and site**.**

If the basal area is below this standard after the MechT2 removal, then

STOP

Rx –75: Gap-30: This Prescription thin all stem less than 30-inches DBH. It is used for extreme cases in defense zone and to simulate GAP regeneration that is group selection with only tree over 30-inches left standing. This Rx pushes to the limit in order to generate product and value. In essence, this a shelterwood where all trees greater than 30 are seed trees and there is NO removal cut.

Rx-80’s: Mechanical Treatment that permit Regeneration Harvest and harvest of trees over 30-inches for purposes other than Fuel

Rx –81: GrpSel: Group Selection were the treatment units up to 2.5-ac in size are treated like small regeneration or clear cut units.

Rx –83: Mtx-GS: Matrix Group Selection based on large stand basis were treatments are seen as inclusions within the stand but stand classification is based on the total stand, both treated and untreated.

Rx –85: GrnTre: Green Tree Retention [shelterwood with removal harvest] was on leaving 8 trees greater than QMD proportionally assigned.

Rx –87: ShltWd: Tradition Shelterwood based on 2 or 3 cycles (prep, seed, and removal harvest).

Rx –88: Adv-CC: Clear cutting or type conversion with advance regeneration maintained.

Rx –89: CC-TC-: Clear cutting or type conversion without advance regeneration.

Appendix C: Consistency Review of Documentation for the Sierra Nevada Forest Plan Amendment

Introduction

The project interdisciplinary team reviewed the January 2000 Final Environmental Impact Statement (FEIS) for the Sierra Nevada Forest Plan Amendment (SNFPA) to determine whether plan changes now under consideration would result in environmental effects that were not assessed in the FEIS. This appendix documents the results of that consistency review. It identifies environmental effects of implementing proposed changes considered in this supplemental environmental impact statement (SEIS) that are adequately addressed in the FEIS and identifies those subjects for which additional effects analysis is needed. Some of the needed new effects analyses are presented here, but most of them comprise Chapter 4 of this SEIS.

Purpose and Need (FEIS Chapter 1)

The purpose of the actions analyzed in the FEIS was to address five needs in the Sierra Nevada:

- protecting, increasing, and perpetuating old-forest ecosystems;
- protecting and restoring aquatic, riparian, and meadow ecosystems;
- providing adequate fire protection and reducing fuels;
- controlling the spread of noxious weeds; and
- restoring and sustaining hardwood forests growing at lower elevations on the westside of the range.

The proposed actions in the SEIS are refinements to measures addressing these needs that were considered in the FEIS. These refinements to the purpose and need are discussed in chapter 1 of the SEIS.

The Alternatives (FEIS Chapter 2)

The FEIS considered eight action alternatives that represented different approaches for addressing the five needs. These alternatives were brought forward into the draft SEIS, and a new alternative was formulated. The proposed changes considered in the SEIS are consistent with the range of management options that were evaluated in the FEIS through the formulation of the eight original alternatives. The consequences of the proposed changes are also within the range of consequences described in the FEIS for the eight alternatives.

Landscape Patterns and Vegetation Dynamics (FEIS Chapter 3, Part 3.1)

This section of the FEIS contains key concepts, definitions, and metrics for describing Sierra Nevada landscapes. These descriptors were reviewed for applicability to the SEIS and were found to be applicable.

Hardwood Ecosystems (FEIS Chapter 3, Part 3.3)

As noted above, sustaining westside hardwood ecosystems was identified in the FEIS to be one of the five management needs. A detailed assessment of hardwood ecosystems is presented in this section of the FEIS. A conservation strategy for these ecosystems, and standards and guidelines for management of hardwood species, were developed and adopted in the record of decision (ROD) for the FEIS. Chief among the standard and guidelines are retention requirements for large hardwoods. The proposed changes assessed in the SEIS would not alter the existing strategy or change the specific hardwood standards and guidelines. Therefore, no further assessment of impacts to hardwood ecosystems is needed.

Soil Quality (FEIS Chapter 3, Part 3.8)

The discussion of effects on soil quality of management activities in the FEIS was reviewed and found to remain valid, irrespective of newly available information and results of analyses conducted for the SEIS. Effects of the new alternative were determined to be similar to those analyzed for the FEIS since the treatment acres remain the same (see section 4.2.7 of the SEIS).

Other Forest Products (FEIS Chapter 3, Part 5.2)

The FEIS presented general observations about the relationships of fire to commercial harvesting of non-wood forest products, such as cones, ferns, and mushrooms. These relationships are still considered to be valid. The proposed changes considered in the SEIS would not invalidate the effects assessment in the FEIS, and no additional analysis is needed.

Mining and Mineral Resources (FEIS Chapter 3, Part 5.4)

Environmental consequences of mining primarily affect riparian areas. Since the proposed action does not entail a change in the SNFPA Aquatic Conservation Strategy, the effects analysis in the FEIS for mining remains valid and no additional analysis is needed.

Scenic Integrity and Landscape Character (FEIS Chapter 3, Part 5.7)

The FEIS projected that the emphasis on amenity values in all of the action alternatives would enhance both healthy ecosystems and healthy landscapes. This conclusion is based on an assumption that scenery and landscape character will be adequately considered during site-specific project planning and implementation. Implementing the proposed changes considered in this SEIS would result in conditions that are within the range of those described in the FEIS for the various alternatives; therefore no additional analysis is needed.

Heritage Resources (FEIS Chapter 3, Part 5.8)

The FEIS used disturbance acreage, wildfire extent and intensity, fuel reduction acreage, and mileages of road construction and road decommissioning to assess impacts on heritage resources. Low levels of impact were projected for all action alternatives. The proposed changes considered in the SEIS do not alter variables used in that assessment, and no additional analysis is needed.

Energy (FEIS Chapter 3, Part 5.9)

An updated discussion of biomass production is included in this SEIS in chapter 4, section 4.4.1, "Commercial Forest Products."

American Indian Rights and Interests (FEIS Chapter 3, Part 6.5)

Factors used to assess the environmental consequences of the FEIS alternatives on American Indian rights and interests were based on goals for improving government-to-government relations between the Forest Service and American Indian tribes. These factors included coordination and collaboration on fire protection issues, proactive management of culturally significant plants, provisions for appropriate access to sacred and ceremonial sites and traditional use areas, and protection of sensitive traditional knowledge. All of alternatives considered in the FEIS contribute to these goals, differing only by the rate at which they are accomplished. The proposed changes considered in the SEIS do not alter the basis of that assessment and continue the commitment to these goals and formal consultation protocols. Hence, no additional analysis in the SEIS is needed.

Social Impact Analysis and Civil Rights (FEIS Chapter 3, Part 6.6)

The evaluation of social impacts, environmental justice, and civil rights considers people of color, gender-based groups, civic and community organizations, students and youth, the elderly, the poor, working class communities, farm workers, and other labor groups and communities. The environmental consequences of proposed changes considered in the SEIS on employment and income are discussed in chapter 4, section 4.4, "Land and Resource Uses." Effects associated with wildfire risk are discussed in chapter 4, section 4.2, "Physical and Biological Environment." The FEIS discussion of poverty and childhood education would not need to be altered because of the proposed changes. The ability to gather plant materials and to obtain fuel wood would not affected by the proposed changes. Communication and outreach to communities would be maintained under the proposed changes. Hence no additional analysis is needed for this SEIS.

Species of the Sierra Nevada (FEIS Chapter 3, Part 4)

The FEIS provided a detailed evaluation of current status and projected future trends of plant and animal species in the Sierra Nevada. The report presented a hierarchical description that began with effects analysis for broad taxonomic groups and species groups associated with major life zones. More detailed assessments were then made for individual species and groups of species having special status or of special concern. Changes in habitat preferred by these species were evaluated, and changes in finer-scale attributes were assessed for individual species and groups of species using the California Wildlife Habitat Relationships System. For each action alternative, species experts then conducted species viability assessments. The viability assessments were based on the best available information about life history, population status, and habitat requirements of each species. This information was used to project relative historical and projected habitat and population conditions for each species or species group. The FEIS noted that a high degree of uncertainty exists regarding habitat relationships, status and trends, population viability, and other attributes of the vast majority of species in the Sierra Nevada.

Broad-Scale Species Trends (FEIS Chapter 3, Part 4.2)

The FEIS first estimated broad-scale trends for 450 vertebrate species. Trends in preferred habitat types were projected for each species. A cluster analysis was used to compare relative changes in habitat value over time for eight groups of vertebrate species. This analysis suggested that habitat changes would be similar for the various alternatives, because the forested area containing large trees and other habitat improvements would increase under all alternatives. Accordingly, species that find optimal or suitable habitat in old forests and riparian areas would find conditions improved under all alternatives. These improved conditions are also expected to materialize with the implementation of the proposed changes considered in this SEIS. Additional analysis to evaluate these relationships is therefore unnecessary.

Birds

Next, the FEIS projected broad trends for major taxonomic groups of vertebrates. Results indicated that all of the alternatives would affect terrestrial land birds similarly: about half of the species would have more suitable habitat in the future, a quarter would have less habitat, and the habitat for the remaining one-quarter would not change appreciably from current conditions. Species population trends are directly related to trends in preferred habitats. As a result, populations of species that prefer forests with large trees or riparian areas would increase under all alternatives. Species associated with habitats that would not change substantially (e.g. blue-oak woodlands) would not undergo major population change. Those populations of species preferring habitats that would be reduced under all alternatives (e.g. young forests) would decline, but not to levels that would cause concerns for species viability. Implementing the proposed changes considered in this SEIS would produce similar trends. Accordingly, additional effects analysis is not necessary.

For each alternative, the FEIS also compared projected habitat trends for 27 species of raptors in national forests of the Sierra Nevada. The FEIS identified habitat degradation and loss as a primary threat to raptors. Additional factors included nest disturbances, poisoning from pesticides and other chemicals, and direct mortality from shooting. To assess environmental consequences to raptors, the FEIS identified five sub-groups based on broad habitat associations. Major threats to each group were then described, and relative threats of the action alternatives were evaluated for each raptor group:

- Nine species of forest-dwelling raptor species were listed in the *Forest/Woodland Habitat Assessment Group*. Changing forest structure and directly losing habitat were identified as major threats to these species, because these factors can affect nest site suitability and prey availability for this group. Poisoning of prey species was also identified as a threat. With the exception of the great gray owl, only very small changes to current habitat suitability for these species were projected for all of the alternatives in the FEIS. The findings show that none of the alternatives would result in a major loss of important habitat types or key structural characteristics, such as roost and nest trees. The proposed changes considered in this SEIS would also result in small changes in habitat quality for these species. Habitat quality for great gray owls would vary among the alternatives considered in the FEIS and in this SEIS. A discussion of impacts to great gray owls from the proposed changes considered in this SEIS is provided in section 4.3. However, additional analysis to evaluate effects of the proposed changes in this SEIS on other species of this group is not needed.

- Four raptor species were placed in the *Broad Elevational Distribution/Habitat Generalist Assessment Group*. All of these species are abundant in the Sierra Nevada, but they are more abundant in oak-dominated habitats than in conifer forests. Because habitat generalists find suitable habitat in a variety of conditions, very small changes in habitat and population (1-3%) were projected for the alternatives considered in the FEIS. Similar findings would be expected for the proposed changes considered in this SEIS, because these changes would produce habitat conditions that are within the range of conditions projected for the alternatives in the FEIS. Additional analysis is not needed.
- Nine species were listed in the *Low Elevational Distribution/Open Habitats Assessment Group*. This group is comprised of species that are widespread in the Sierra Nevada and prefer grasslands, woodlands, and marshes. Most of these habitats occur on other ownerships, and the FEIS concluded that none of the alternatives would result in a significant change in habitats for this group, because most of the group's critical habitat is managed by others. This finding would also apply to the proposed changes in the SEIS, and additional analysis is not needed.
- Three species were included with the *Broad Elevational Distribution/Open Habitats Assessment Group*. Threats to these rare to uncommon species in the Sierra Nevada include pesticide exposure and loss or degradation of oak woodland and grassland habitats. All of the alternatives in the FEIS would result in very small impacts to these species, because they would not change current pesticide practices, and preferred habitats are largely managed by others. Management practices in preferred habitat on national forest land would enhance habitat for these species under all alternatives in the FEIS. The same result would be expected from implementing the proposed changes considered in this SEIS. Additional analysis is not needed.
- Two species were listed in the *Aquatic Habitats Assessment Group*. Both species require lakes or rivers for nesting and feeding. Pesticide poisoning and loss of nest trees near lakes were identified as the primary risks to these species. Nest trees are widespread in most areas, and use of harmful pesticides has been curtailed for many years in the Sierra Nevada. Neither species would be at appreciable risk under any of the FEIS alternatives or the proposed changes considered in this SEIS, because pesticide use would not increase and nest trees would increase in most areas. Additional analysis to evaluate the proposed changes in the SEIS is not needed.

Amphibians

Conservation of many amphibian species will result from implementation of the SNFPA Aquatic Management Strategy that was included in each alternative assessed in the FEIS. The degree of habitat improvement that would result from an alternative depends upon the number of special protections it includes, such as emphasis watersheds, aquatic diversity areas, critical aquatic refuges, amphibian reserve networks, and requirements for watershed analyses. Alternatives 2 and 5 included all of these protections and would yield the most improvement for amphibian species. The selected alternative (Modified Alternative 8) included critical aquatic refuges and watershed analyses. Other alternatives would include fewer protections than these three alternatives. The proposed action in the SEIS would have effects similar to those of Modified Alternative 8 (Alternative S1 in the SEIS) because it involves the same programs for aquatic habitat protection.

A group of amphibians (California red-legged frog, foothill yellow-legged frog, Cascades frog, mountain yellow-legged frog, northern leopard frog, and Yosemite toad) inhabits forest and rangeland habitats and is identified as "high risk." Effects on each of these six species were fully evaluated in the FEIS, and, with respect to the proposed changes, are also described in section 4.3 of this SEIS.

Another group of amphibians is most affected by conditions that would not be influenced by actions considered in the FEIS, such as fish stocking, hydroelectric development, pesticide use, and other non-Forest Service actions. No FEIS or SEIS alternative would have an appreciable impact on this group. No additional analysis is needed for this group of amphibians.

Fish

The FEIS identified a variety of risk factors for native Sierran fishes, including the introduction of non-native fish, construction or operation of dams and other water diversions, alteration of aquatic habitats, and disturbance of watersheds. The effects of national forest management activities on fish, varies considerably, depending upon the nature of habitat disturbances and the life-history patterns and distribution of the species. The FEIS concluded that alternatives that involve use of landscape analysis to identify and protect special aquatic management areas (refuges, diversity areas, etc.) would provide the best conditions for fish species at risk. Alternatives 2, 5, 6, 8, and Modified 8 would provide special areas that are managed, at least in part, for the benefit of fish. Alternative Modified 8 would provide the largest area of critical aquatic refuges, thereby providing greater protection for fish than the other alternatives. The proposed changes considered in the SEIS would not alter the existing strategy for completing landscape analysis or protecting special management areas included in Alternative Modified 8. Protection of most fish would therefore be similar, and further evaluation of potential impacts of the proposed actions is not needed. The Biological Assessment for the SEIS considered potential affects of alternative S2 on ten species of fish and their critical habitat.

Reptiles

The FEIS included general observations about the effects of forest management on reptiles. It reported that most reptile species are widely distributed, occupy ranges that are much larger than the national forests, and are most abundant in the lower elevations of the western slope of the Sierra Nevada. Their distribution makes them susceptible to grazing, logging, prescribed fire, and other land treatments. The degree of risk is directly related to the intensity of land treatment. However, no species is subject to appreciable risk at this time. Furthermore, the Forest Service does not manage the preponderance of the range for these species, so no significant adverse impacts were projected for any of the alternatives analyzed in the FEIS. A similar finding applies to the proposed changes in the SEIS. Because the Forest Service does not manage large portions of the ranges of any reptile species in the Sierra Nevada, no additional impact analysis is needed in the SEIS.

Assessments of Individual Species

Endangered, Threatened, and Proposed Species (FEIS Chapter 3, Part 4.3)

Mammals

Sierra Nevada Bighorn Sheep

New information regarding the Sierra Nevada bighorn sheep was identified after discussing its status with knowledgeable Forest Service personnel. This species lives almost entirely on federal land. It has been determined through survey information (Milano pers. comm.) that the sheep population in the Sequoia-Kings National Park/Inyo National Forest is at least 250 animals and possibly as high as 300 animals. A new herd was discovered that is wintering west of the Sierra Nevada crest in the Charlotte Dome/Bubbs Creek area of Sequoia-Kings Canyon National Park in the Kings River watershed. Approximately 18-19 animals were observed on January 20, 2003. The Wheeler Ridge herd is now of sufficient size to allow the California Department of Fish and Game to capture and transplant sheep to supplement the Mt. Baxter herd during the 2003 spring season.

The FEIS compared the effects of the alternatives on the population of Sierra Nevada bighorn sheep. The document noted that recent population declines in this species were primarily influenced by predation; disease passed from domestic sheep; and degraded forage from fire exclusion. In the FEIS, effects of the action alternatives on bighorn sheep were displayed by comparing the levels of fuels treatments on the Inyo National Forest. The assessment assumed that more fuels treatment results in less predator hiding cover and more high-quality forage for sheep. Alternatives 3, 4, 6, and 7 involved similar high levels of fuels treatment (roughly 150,000 acres). Modified Alternative 8 involves an intermediate level of treatment (112,000 acres), and the remaining alternatives involved less treatment, ranging from 35,000 to 98,000 acres. The proposed changes considered in this SEIS would provide sheep habitat improvement that is comparable to Modified Alternative 8. Further assessment of the impacts of the proposed changes on Sierra Nevada bighorn sheep is documented in the *Biological Assessment for the SNFPA SEIS, July 30, 2003*.

Birds

Bald Eagle, California Condor, and Southwestern Willow Flycatcher

The assessments in the FEIS for these species did not identify appreciable differences in effects among the alternatives. Implementing the proposed changes considered in the SEIS would not result in conditions that would be discernibly different from those conditions that would result from the FEIS alternatives. Further assessments of impacts to these species are documented in the *Biological Assessment for the SNFPA SEIS, July 30, 2003*.

Fish

Little Kern Golden Trout, Paiute Cutthroat Trout, Lahontan Cutthroat Trout, Modoc Sucker, Warner Sucker, Shortnose Sucker, Lost River Sucker, Spring Run Chinook, Winter Run Chinook, Central Valley Steelhead

The FEIS presented a comparison of projected habitat and population outcomes among the alternatives for each of these species. No differences among the alternatives were identified. Implementing the proposed changes considered in the SEIS would not be expected to produce appreciably different results. Effects on these species are documented in the *Biological Assessment for the SNFPA SEIS, July 30, 2003*.

Owens Tui Chub, Cowhead Lake Tui Chub, Owens Pupfish, Sacramento Splittail

Except for the Owens Tui chub, these species do not occur on the national forests in the Sierra Nevada. Effects on the Owens Tui chub were analyzed and documented in the *Biological Assessment for the SNFPA SEIS, July 30, 2003*.

Forest Service Sensitive Species (FEIS Chapter 3, Part 4.4)

Mammals

Pacific Fisher

The Pacific fisher has been extirpated from much of its historic range in the Sierra Nevada. The species is known to be sensitive to management actions that disturb old forests. Because the proposed changes evaluated in the SEIS would modify forest management practices in the Sierra Nevada, the environmental consequences of the proposed changes on this species were analyzed. The results of such analysis are described in detail in Section 4.3 of this document.

Marten

The FEIS evaluated the effects of the alternatives on marten habitat. Marten habitat was projected to remain broadly distributed across the species' current and historic ranges under all alternatives. Proposed changes considered in this SEIS would influence habitat factors that are important to this species. Therefore, the environmental consequences of the proposed changes on this species were analyzed and are described in detail in Section 4.3 of this document.

Sierra Nevada Red Fox

This species is an inhabitant of higher elevation (generally above 7,000 feet), meadow-dominated habitats of the Sierra Nevada. This fox is indistinguishable from the introduced red fox that inhabits lower elevations. It prefers meadow complexes interspersed with a variety of forest types. Roughly 70% of its range occurs on national forest land. The availability of rodent and lagamorph prey may limit populations. Fire exclusion is thought to have resulted in an overabundance of dense forests adjacent to meadows, which is not habitat preferred by the Sierra Nevada red fox. Population status of this species is presently uncertain, but population may be declining in response to deterioration of meadows and adjacent forests. Grazing may also reduce prey availability and exacerbate a declining population trend. Increased human use of preferred habitats in summer and winter may also negatively affect this species.

The FEIS assessed the relative effects of the action alternatives by comparing levels of grazing and meadow protection, fire occurrence, and recreation activity. The current patchy distribution of habitat was judged unlikely to be appreciably affected by any of the FEIS alternatives, primarily because this species lives at elevations where human use, grazing, and fire are limited. Implementation of the proposed changes would have similar results and additional analysis in the SEIS is therefore not needed.

Wolverine

The status of the wolverine in the Sierra Nevada has been unclear for many years. In the early 1900s, their populations declined, largely due to trapping, and by 1933, no more than 30 animals were thought to occur in California. Occasional sightings are still reported, but the persistence of this species in the Sierra

Nevada is questionable as there has been no documented evidence of wolverine presence for the last 50 years (FEIS 4.4.1.4 page 45).

Throughout their range in North America, wolverines prefer remote forested and alpine areas. They appear to be most impacted by increasing human use of their habitats. The FEIS assessed the effects of the alternatives on wolverines by comparing levels of emphasis on wolverine surveys and protection and anticipated road densities, recreation activity, and forest structure. Alternative 5 would have involved wolverine surveys and direct protection where sightings occur, and it was judged adequate to allow continuation of the current status of the wolverine in the Sierra Nevada. The remaining alternatives did not provide specific management direction for protection of wolverines. These alternatives provided varying levels of road, recreation, and forest management. They were all judged to provide slight decreases in overall habitat suitability for wolverines. The FEIS concluded that none of the action alternatives would result in any improvement in the distribution or abundance of this rare carnivore (FEIS 4.4.1.4, page 53). Similar conditions would result from implementing the proposed changes considered in this SEIS.

Pallid Bat and Townsend's Big-Eared Bat

These bat species are widespread in the Sierra Nevada. Both species roost in caves or abandoned mines, and forage over adjacent forest and rangeland habitats. They appear to be most impacted by physical changes or human disturbances of roost sites. Bat responses to changes in terrestrial habitats are poorly understood but do not appear to be significant under current management practices. These species were evaluated in the FEIS by comparing amounts of fuels treatment and the management programs for terrestrial habitats. None of the alternatives was judged to likely result in a change in species status from the current condition. The proposed changes considered in this SEIS are also not expected to result in a change in status of either species. None of the management options would affect roost sites, which are the primary limiting factor for pallid and Townsend's big-eared bats. Additional analysis of effects on these bat species is therefore not needed.

Sierra Nevada Snowshoe Hare

The Sierra Nevada snowshoe hare is widespread in North American boreal forests. A small but stable population persists in the Sierra Nevada, where the species has probably never been abundant. The California Department of Fish and Game lists this hare as a *species of special concern* and a *harvest species* in the state. The preferred habitat for snowshoe hares in the Sierra Nevada is riparian forest that includes willows or alders. The effects of the alternatives in the FEIS were assessed by comparing grazing practices, amount of fuels reduction work, and standards for managing meadows and riparian areas. The assessment concluded that Alternatives 2, 3, 5, 6, 8, and Modified 8 would improve the existing conditions for snowshoe hares in the Sierra Nevada, because these alternatives include reductions on grazing and greater protection of riparian areas and meadows. Alternatives 4 and 7 would not result in changes relative to the no-action alternative. Implementation of the proposed changes considered in this SEIS would result in similar conditions to those resulting from Alternatives 2, 3, 5, 6, 8, and Modified 8, because these changes would still result in the same level of protection for riparian areas and most meadows. Additional analysis of effects on this species is not needed.

Birds

California Spotted Owl

Forest management can impact the California spotted owl. Because the proposed changes considered in this SEIS would change forest management practices in the Sierra Nevada, environmental consequences of the proposed changes affecting this species were analyzed. The results are described in detail in Section 4.3 of this document.

Northern Goshawk

Forest management can impact the northern goshawk. Because the proposed changes considered in this SEIS would change forest management practices in the Sierra Nevada, environmental consequences of the proposed changes affecting this species were analyzed. The results are described in detail in Section 4.3 of this document.

Willow Flycatcher

Livestock grazing can impact the willow flycatcher. Because the proposed changes considered in this SEIS would change grazing management in the Sierra Nevada, environmental consequences of the proposed changes affecting this species were analyzed. The results are described in detail in Section 4.3 of this document.

Greater Sandhill Crane

The greater sandhill crane inhabits the northeastern Sierra Nevada during spring and summer, where it breeds in remote areas of extensive wetlands and shallow marshes. Three subspecies may breed in northwestern California, and most of the breeding habitat is on private land. Sandhill cranes do not use national forest land in the Sierra during winter. The species is considered by the State of California to be threatened, but populations appear to be increasing.

The FEIS concluded that the most significant impacts to the greater sandhill crane are associated with livestock grazing in meadows and wetlands. It evaluated effects of alternatives on the species by comparing each alternative’s standards for grazing and riparian/meadow protection. Alternatives 2, 3, 5, and Modified 8 would not change current habitat value for greater sandhill cranes, because they provide important habitat protections from grazing in riparian and meadow habitats. These alternatives were also expected to improve the species’ population status over time. The other alternatives would cause declines in habitat quality and population status over time, because they would not provide as high a level of habitat protection. Implementation of the proposed changes considered in this SEIS would improve habitat and population status for sandhill cranes, because they would still involve the same level of protection for riparian areas and most meadows as under Alternative Modified 8. Additional analysis of effects on this species is not needed.

California Yellow-billed Cuckoo

The California yellow-billed cuckoo is listed as a sensitive species by the Forest Service and an endangered species by the State of California. Populations of this neotropical migrant have declined substantially in North America over the past several decades. The principle reason for the decline is the large-scale reduction in deciduous riparian forests, which constitute the species’ required habitat. Only one breeding population of yellow-billed cuckoos occurs on national forest land in the Sierra Nevada today (and grazing or other significant vegetation disturbance is not permitted in that area). Accordingly, none of the alternatives in the FEIS or the proposed changes considered in this SEIS would have any effect on cuckoos. Additional analysis of effects on this species is not needed.

Amphibians

Foothill Yellow-Legged Frog

The foothill yellow-legged frog occurs primarily in lower elevation riparian zones, where it has been extirpated from about two-thirds of its historical range. The most significant factors that influence population trends are water diversion, urbanization, mining, grazing, recreation, and pesticide use. The FEIS noted that the Forest Service has little influence on most of the land and activities that are important to this species. It was therefore concluded that all of the FEIS alternatives would result in similar habitat conditions for the foothill yellow-legged frog and would not create a risk to the species. The proposed changes considered in the SEIS may have similar results. The environmental consequences of the proposed changes are described in detail in Section 4.3 of this document.

Mountain Yellow-Legged Frog

This species inhabits high-elevation lakes, ponds, and streams in the Sierra Nevada where it is susceptible to predation by exotic fish, pesticides poisoning, and trampling from cattle, pack stock, and recreationists. The FEIS noted that the Aquatic Management Strategy, which was included in some alternatives and adopted in the ROD, is the key to conserving this species. However, the proposed changes addressed in the SEIS would change some grazing practices, requiring that additional effects analysis be completed for this species. The results are provided in Section 4.3 of this document.

Yosemite Toad

The Yosemite toad is a species for which specific grazing management direction was adopted in the ROD. The proposed changes evaluated in the SEIS would modify this direction. Accordingly, the effects of the proposed changes on the Yosemite toad require evaluation. This information is provided in Section 4.3 of the SEIS.

Cascade Frog and Northern Leopard Frog

These species inhabit the streams and ponds of the northern Sierra Nevada. Like many other amphibians, they are thought to be affected by a variety of factors including water diversions, predation by exotic fish and amphibians, pesticide poisoning, and grazing. The Aquatic Management Strategy was developed for some alternatives in the FEIS to conserve important aquatic resources, including at-risk amphibians. The proposed changes in the SEIS would change some grazing practices. Therefore, additional analysis of effect on these species is needed. The results are provided in Section 4.3 of this document.

Batrachoseps Relictus Species Complex and Other Sensitive Salamanders

The FEIS described a small list of salamander species that typically occur as small, localized populations in the Sierra Nevada. The status and habitat relationships of these species are poorly understood, but they are thought to be particularly sensitive to further isolation of small disjunct populations. The FEIS concluded that it is not possible to assess the effects of management on these species at the scale of the entire Sierra Nevada. Assessments for these animals must be completed through the biological evaluation process at the project level, where potential impacts and appropriate mitigations can be identified. This approach would continue if the proposed changes were adopted.

Fish

Goose Lake Lamprey, Fall Run Chinook, Eagle Lake Rainbow Trout, Volcano Creek Golden Trout, Goose Lake Redband Trout, Warner Valley Redband Trout, Lahontan Lake Tui Chub, Goose Lake Tui Chub, and Hardhead

The FEIS described the life history, habitat relationships, population status, and risk factors for each of these species in the Sierra Nevada. Most of these species are isolated within one to several lakes or watersheds. Risk factors for most of the species involve habitat degradation from combinations of reduced flow; increased temperature, sediment, and/or pollutants; and in stream changes to important structural features. The FEIS evaluated the potential effects of the alternatives on these fish species by comparing the level of protection that would be afforded riparian and in stream fish habitats. Alternatives 2, 5, 6, 8, and Modified 8 would all provide special management areas that would be developed, in part, to enhance fish habitat value. Moreover, these alternatives would involve *landscape analysis* to identify critical aquatic refuges, and would require that watershed restoration be a high priority. Alternative 5 would provide additional protection by providing an even larger area where protective management was emphasized. Alternative 4 and 7 would result in protection that would be similar to that resulting from the no-action alternative (#1). Implementation of the proposed changes considered in this SEIS would result in conditions that would be similar to those resulting from Alternative Modified 8, because the Aquatic Management Strategy would be unchanged. Further analysis of effects on these species is therefore not needed.

Reptiles

Northwestern Pond Turtle

The northwestern pond turtle is a resident of permanent lakes, ponds, and slow-moving rivers below 6,000 feet on the west slope of the Sierra Nevada. Risk factors for the species include habitat degradation from cattle grazing, roads, and logging near riparian areas. Predation by introduced fish and amphibian species is also an issue in some areas. The FEIS evaluated the effects of the action alternatives by comparing programs for vegetation treatment, road building, recreation, grazing, prescribed fire, and fuel wood harvest in riparian areas. Alternatives 2, 5, and Modified 8 were judged to provide the most protection for pond turtles. Implementation of proposed changes considered in this SEIS would have similar effects, because they do not involve modification of the protections provided in Alternative Modified 8. Additional assessment is therefore not needed for effects on the northwestern pond turtle.

California Legless Lizard

California legless lizards are typically found in damp soil along streams in chaparral, pine-oak, and deciduous woodland communities of the southern Sierra Nevada. Populations are strongly influenced by noxious weed introductions, trampling from grazing, and off-road vehicle disturbances. Prescribed fire benefits this species because it curtails invasive species without appreciable soil disturbance. The FEIS compared vegetation treatments that would be carried out under each alternative and found that Alternatives 3, 6, 8 and Modified 8 would provide the best overall habitat for legless lizards, because they would include the largest programs of prescribed fire. Implementation of the proposed changes considered in this SEIS would yield similar results, because the program of prescribed fire would be similar to that of Alternative Modified 8. No additional effects analysis is therefore warranted for the California legless lizard.

Sierra Night Lizard and Panamint Alligator Lizard

These species are highly isolated and are very poorly understood. Impact assessments can be most usefully conducting during planning for individual projects. Evaluating management-caused changes in the status of these animals at the scale of the entire Sierra Nevada is not meaningful.

Coast Horned Lizard

The coast horned lizard inhabits undisturbed sandy areas on the lower westside edge of the Sierra Nevada. It typically occurs in habitat that is below the elevation of the national forests. Primary risk factors include urban development and road building, introduction of noxious weeds, and off-highway vehicle use. This species was not evaluated in detail in the FEIS because the factors that are important for its persistence are almost entirely the responsibility of other land managers. For the same reason, additional analysis of effects of changes considered in this SEIS is unnecessary.

Moderately and Highly Vulnerable Species and Species of Concern (FEIS Chapter 3, Part 4.5)

Individual Species Assessments

In this section, the FEIS described a variety of individual species that have special habitat requirements that make them vulnerable to land management. The species are:

Mammals	Birds	Fish	Amphibians
White-tailed hare	Band-tailed pigeon	Rough sculpin	Mount Lyell salamander
Pygmy rabbit	Black tern	Kern brook lamprey	
Spotted bat	Forster's tern	Pacific lamprey	
Small-footed myotis	Swainson's thrush	Kern River rainbow trout	
Silver-haired bat	Yellow-breasted chat	Owens sucker	
Long-legged myotis	Bank swallow	Mountain sucker	
Hoary bat	Long-eared owl	Eagle Lake tui chub	
Fringed myotis	Olive-sided flycatcher	Pit River tui chub	
Western mastiff bat	Mountain white-crowned sparrow	Sacramento hitch	
Western red bat		Owens speckled dace	
Long-eared myotis		Pit River roach	
		Red River roach	
		San Joaquin roach	

None of the terrestrial species listed above would be affected by alternatives considered in the FEIS or the proposed changes considered in this SEIS because they are: 1) uncommon on the national forests of the Sierra Nevada; and/or 2) largely influenced by factors that would not be changed. For these reasons, the FEIS did not involve effects analyses for these species, and no additional assessment in this SEIS is needed.

Risk factors for the fish species include habitat degradation from combinations of reduced flow; increased temperature, sediment, and/or pollutants; and in stream changes to important structural features. The FEIS evaluated the potential effects of the alternatives on the fish species by comparing the levels of protection that would be afforded riparian and in stream fish habitats. Alternatives 2, 5, 6, 8, and Modified 8 would all provide special management areas that would be developed, in part, to enhance fish habitat value. These alternatives would involve *landscape analysis* to identify critical aquatic refuges, and would require that watershed restoration be a high priority. Alternative 5 would provide additional protection by providing an even larger area where protective management was emphasized. Alternative 4 and 7 would result in protection that would be similar to that resulting from the no-action alternative (#1). Implementation of the proposed changes considered in the SEIS would result in conditions that would be similar to those resulting from Alternative Modified 8, because the Aquatic Management Strategy would be unchanged. Further analysis of effects of proposed changes on these fish species is not needed.

Aquatic Invertebrates

The biology of aquatic invertebrates in the Sierra Nevada is poorly understood. Viability of 21 species of aquatic invertebrates was evaluated in the FEIS. These species are susceptible to adverse impacts from dams and diversions, livestock grazing, and alteration of riparian habitat. The species are dependent on perennial sources of high-quality water and, in terms of their habitat requirements, are believed to be representative of many other aquatic invertebrate species in the region.

The FEIS compared programs for managing risk factors among the alternatives. Habitat values for three species of aquatic invertebrates were correlated with the grazing practices in important habitats for willow flycatchers and at-risk amphibians. Viability of aquatic invertebrates was also related to the overall grazing utilization standards in each alternative. The FEIS concluded that Alternatives 2, 8, and Modified 8 would provide the greatest assurances of viability of aquatic invertebrates and that Alternatives 3, 4, and 7 would provide the least assurances. The proposed changes considered in this SEIS would alter current grazing utilization standards and grazing practices in some important wildlife habitats, but only when the trend in rangeland condition is improving. For this reason, the effects of implementing the proposed changes would be similar to effects evaluated for FEIS Alternatives 2, 8, and Modified 8. Additional analysis of effects on aquatic invertebrates is therefore unnecessary.

Reptiles

The FEIS identified 15 species of reptiles that are either *management indicator species* or species moderately vulnerability to national forest management. The species were divided into three groups according to their habitat associations. All of the species were judged to be widespread, and none is threatened at this time. The FEIS concluded that none of the alternatives would affect the viability of any species, because each alternative would increase the amount of forest having open canopy conditions that are preferred by reptile species. The open canopy conditions would be result from forest thinning and prescribed fire. Similar conditions would result from implementing the changes considered in the SEIS. Therefore, no additional analysis is needed in the SEIS.

Vascular Plants, Bryophytes, and Fungi (Part 4.6, pages 1-75)

New information on plant species, including information from recent surveys and refinements of threats, is included in Chapter 3, Affected Environment.

An analysis of vulnerability was conducted for each of the 135 Threatened, Endangered, and Sensitive plant species based on perceived population trend (declining, unknown, stable, or increasing) and the number of threats (out of a total of 22). A statistical analysis was conducted to group species into categories of high, moderate, and low vulnerability. Species with declining or unknown population trends and/or a higher number of threats rated out as most highly vulnerable (see Appendix R of the FEIS, page R-97 for a full description of this process and a list of the species). The method selected to address concerns for these 28 species rated as highly vulnerable was to complete two Conservation Assessments per year (page 14 of ROD). The SEIS would not change this commitment to complete the Conservation Assessments.

In addition, the FEIS evaluated the effects of the alternatives on these 135 species by subdividing them into 14 ecological guilds according to their habitat associations. Many of the species were included in multiple guilds. The species within each guild were described and the risk factors for associated species were listed. The risk factors were then used to assess the effects implementing the alternatives on each species for 50 years. Assessments were completed for overall habitat and population trends.

For the species that were sensitive to national forest management, all were judged to have adequate protection to avoid the loss of viability and a trend towards listing in all of the alternatives. Protection would be provided by surveys and biological evaluations for ground-disturbing projects under all alternatives. Appropriate protection measures and mitigations would be identified at that time. Implementing the proposed changes would not change this process. So no threats to viability or trends towards listing would occur with these changes. Further analysis is not warranted in the SEIS.

Appendix D: Willow Flycatcher Sites in the Sierra Nevada Forest Plan Amendment Planning Area Analysis to support the Supplemental Environmental Impact Statement

The analysis conducted displays the willow flycatcher site association and territory point land ownership along with allotment status and type and the site classification under Alternative S2. Willow flycatcher SNFPA was derived from the current willow flycatcher SNFPA database (dated 11/10/2003) and geographic information system (GIS) data from the Pacific Southwest Region's Remote Sensing Lab for willow flycatcher occupied site point locations (snvwfpt00_1) and willow flycatcher meadow habitat polygons (snvwifl01_2). Range allotment data was derived from a spreadsheet with allotment status (alot.xls 1/17/2003) and GIS data from the Pacific Southwest Region's Remote Sensing Lab for Range allotments on National Forests in California (r5alot99_1). Metadata for each of the GIS coverage's used is available in the planning record.

Each willow flycatcher occupied site point is a geographic reference to a central point representing the territory or territories of that site. The locational accuracy of each point is unknown, but it is known that there is variability in the accuracy of these points. In some cases, the points represent actual nest stand locations collected using handheld global positioning system equipment while in other cases the point may represent the center of a meadow occupied by more than one territory. Additional sites have been detected from 2002 and 2003 surveys that are not included in this database because the data has not been input at the time of analysis.

The willow flycatcher habitat polygons were derived from a Sierra-wide meadow vegetation layer to identify wet or moist meadows supporting woody vegetation, particularly willows.

Analysis consisted of determining if the occupied site points occurred on National Forest or other land ownership and if it occurred in a range allotment. The willow flycatcher spreadsheet and range allotment spreadsheet were then used to determine the Alternative S2 site occupancy category for each site and the range allotment status and livestock kind for the allotment.

Table 1 displays information for all current records of willow flycatcher within the Sierra Nevada Forest Plan Amendment planning area, except for the five records for the southwestern willow flycatcher which are displayed in Table 2. These two tables show the categorization of all 135 willow flycatcher sites identified in the SNFPA FEIS

Table 1. Willow Flycatcher sites in Sierra Nevada Forest Plan Amendment Planning Area (excluding southwestern Willow Flycatcher; see Table 2). Note: ***italic bold*** numbers indicates the 17 territory points on private land with associated meadow polygon that extends onto National Forest land.

Point Location		**Willow Flycatcher**		**Allotment**			**Alt S2 Occupancy Category**				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Eldorado	Eldorado	25	Upper Forni	Pyramid	A	Cattle			1		1
	Eldorado Total								**1**		**1**
Eldorado Total									**1**		**1**
Inyo	Inyo	70	June Lake	June Lake	A	Sheep			1		1
		74	Lee Vining Creek	Bloody Canyon	N	-			1		1
		100	Bohler Canyon	Bloody Canyon	A	Sheep	1				1
		103	Rush Creek	June Lake	N	-			1		1
		125	Willow Campground	Coyote	N	-	1				1
		168	Cottonwood Creek	Cottonwood	I	-		1			1
		169	Ellery Lake	Bloody Canyon	N	-		1			1
		170	Mammoth Creek	Sherwin/Deadman	N	-				1	1
		171	Parker Lake	Bloody Canyon	N	-		1			1
	Inyo Total						**2**	**3**	**3**	**1**	**9**
	Point not on NF	72	Rush Creek/Silver Lake	June Lake	N	-			1		1
		93	Birch Creek	Taboose Creek	N	-			1		1
		98	Alpers Ranch	Alpers Canyon	A	Cattle			1		1
		105	Lundy Canyon	Dunderberg	N	-			1		1
		165	Farmington Ranch	Coyote	N	-		1			1
		166	Carl Walters Ranch	Independence	N	-		1			1
		167	Convict Creek	Hot Creek	N	-		1			1
	Point not on NF Total							**3**	**4**		**7**
Inyo Total							**2**	**6**	**7**	**1**	**16**
Kings Canyon	Point not on NF	175	Grants Grove	Converse/Hoist	N	-			1		1
		176	Cedar Grove	Middle Fork	N	-			1		1
		177	Zumwalt Meadow	Middle Fork	N	-			1		1
		182	Kern River	Whitney	N	-			1		1
		183	Simpson Meadow	Black Cap	N	-			1		1
	Point Not on NF Total								**5**		**5**
Kings Canyon Total									**5**		**5**

Point Location		**Willow Flycatcher**		**Allotment**			**Alt S2 Occupancy Category**				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Lassen	Lassen	41	Humbug and Miller Creeks	West Humbug	A	Cattle			1		1
		43	Gurnsey Creek	Deer Creek	A	Cattle			1		1
		46	Robbers Creek/Mason Station	Duck Lake	A	Cattle			1		1
		48	Robbers Creek/Swain Meadow	Robbers Creek	A	Cattle			1		1
		144	Butt Creek Beaver Ponds	Butt Creek	A	Cattle			1		1
		148	Hay Meadow	Benner Creek	I	-			1		1
		149	Savercool Place	Tehama C&H	I	-			1		1
		151	Willow Lake	Feather River	A	Cattle			1		1
		152	Brokenshire Mill Creek	Morgan Springs	A	Cattle			1		1
		153	Westwood Junction	Bridge Creek	A	Cattle	1				1
	Lassen Total						**1**		**9**		**10**
	Point not on NF	44	Westwood	Duck Lake	N	-			1		1
		45	Battle Creek Meadows	Lyonsville	N	-			1		1
		47	Warner Valley Wildlife Area	Feather River	N	-			1		1
		50	Bear Creek	Cayton	N	-			1		1
		143	Mineral	Lyonsville	N	-			1		1
		145	Ruffa Ranch	Butt Creek	A	Cattle			1		1
		146	Martin Ranch	Soldier Meadows	N	-			1		1
		147	Chester	Soldier Meadows	N	-			1		1
		150	Spencer Meadow	Rice Creek	A	Cattle			1		1
	Point Not on NF Total								**9**		**9**
Lassen Total							**1**		**18**		**19**
LTBMU	LTBMU	10	Grass Lake	Trout Creek	N	-			1		1
		11	Upper Truckee	Meiss	N	-			1		1
		14	Taylor Creek	Baldwin	N	-			1		1
		26	Ward Creek	Sierra Crest	N	-			1		1
	LTBMU Total								**4**		**4**
	Point Not on NF	***13***	Washoe Meadow State Park	Trout Creek	N	-			1		1
		83	Sierra House	Cold Creek	N	-			1		1
		154	Truckee Marsh	Cold Creek	N	-		1			1
	Point Not on NF Total							**1**	**2**		**3**
LTBMU Total								**1**	**6**		**7**

Point Location		Willow Flycatcher		Allotment			Alt S2 Occupancy Category				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Modoc	Modoc	51	Blue Lake Ranch Meadow	Blue Lake	A	Sheep	1				1
		137	Dismal Swamp/Twelve Mile Creek	Mt. Bidwell	A	Cattle			1		1
		139	Mosquito Creek	Bear Camp	A	Cattle			1		1
		140	Willow Creek	Carr	A	Cattle			1		1
		141	Bearcamp 2	Bear Camp	A	Cattle				1	1
		142	Bearcamp 1	Bear Camp	A	Cattle				1	1
	Modoc Total						**1**		**3**	**2**	**6**
	Point not on NF	49	Dry Creek	Delta Lake	N	-			1		1
	Point not on NF Total								**1**		**1**
Modoc Total							**1**		**4**	**2**	**7**
Plumas	Plumas	20	Graeagle Lodge	Gold Valley	N	-			1		1
		21	Grass Lake	Gold Valley	N	-			1		1
		23	Faggs Pond	Bucks Creek	N	-			1		1
		36	Mcrae Meadow	Onion Valley	N	-			1		1
		37	Delleker	Willow Creek	N	-			1		1
		38	Rocky Point	Ramelli Ranch	N	-			1		1
		40	Round Valley Reservoir	Lights Creek	N	-			1		1
		42	Little Antelope Creek	Antelope Lake	A	Cattle			1		1
		107	Ramelli Ranch	Ramelli Ranch	A	Cattle			1		1
		109	East Portola	Beckwourth Peak	N	-			1		1
		111	Mill Creek	Bucks Creek	A	Cattle			1		1
		114	Doyle Crossing	Fitch Canyon	A	Cattle			1		1
	Plumas Total								**12**		**12**
	Point not on NF	22	Solari Meadow	Gold Valley	N	-			1		1
		35	Middle Fork Feather River	Beckwourth Peak	N	-			1		1
		39	Haskins Valley	Bucks Creek	N	-			1		1
		106	Smith Creek	Long Valley	N	-			1		1
		110	Williams Loop	Onion Valley	N	-			1		1
		113	Arlington Bridge	Lights Creek	N	-			1		1
	Point not on NF Total								**6**		**6**
Plumas Total									**18**		**18**
Sequoia	Sequoia	60	Troy Meadow	Fish Creek	A	Cattle			1		1
		62	Summit Meadow	Horse Corral	A	Cattle				1	1
		84	Crane Meadow	Summit	A	Cattle			1		1
		85	Converse Meadow	Buck Rock	A	Cattle			1		1
		86	Millwood	Converse/Hoist	A	Cattle			1		1
		108	Holey Meadow	Summit	A	Cattle			1		1
	Sequoia Total								**5**	**1**	**6**
Sequoia Total									**5**	**1**	**6**

Point Location		Willow Flycatcher		Allotment			Alt S2 Occupancy Category				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Sierra	Sierra	4	Summit Creek, Deer Camp	Dinkey	A	Cattle			1		1
		5	Summit Creek, Pollard	Dinkey	A	Cattle			1		1
		56	Markwood Meadow	Markwood	A	Cattle			1		1
		57	Grade/Poison Meadow	Markwood	A	Cattle			1		1
		63	Long Meadow	Patterson Mtn	A	Cattle			1		1
		64	Lilly Pad Meadow	Patterson Mtn	A	Cattle			1		1
		81	Ross Meadow	Patterson Mtn	A	Cattle			1		1
		82	Cow Meadow	Mt Tom	A	Cattle			1		1
	Sierra Total								**8**		**8**
	Point not on NF	6	Shaver Dam	Jose	N	-			1		1
		54	Lost Meadow	Dinkey	A	Cattle			1		1
		55	Dinkey Meadow	Dinkey	A	Cattle			1		1
		67	Beasore Meadows	Beasore	A	Cattle			1		1
		136	Sulfur Creek	Jose	N	-			1		1
	Point not on NF Total								**5**		**5**
Sierra Total									**13**		**13**
Stanislaus	Stanislaus	7	Willow Meadow	Herring Creek	A	Cattle			1		1
		8	Long Valley Creek 2	Long Valley-Eagle Meadow	A	Cattle			1		1
		58	Long Valley Creek 1	Long Valley-Eagle Meadow	A	Cattle	1				1
		73	Ackerson Meadow	Middle Fork	A	Cattle			1		1
		76	Upper Bell Meadows	Bell Meadow-Bear Lake	A	Cattle			1		1
		77	Eagle Meadow	Long Valley-Eagle Meadow	A	Cattle			1		1
		156	Hull's Meadow	Lower Hull	A	Cattle		1			1
	Stanislaus Total						**1**	**1**	**5**		**7**
	Point not on NF	***155***	Blood's Meadow	Bear Valley	N	-		1			1
	Point Not on NF Total							**1**			**1**
Stanislaus Total							**1**	**2**	**5**		**8**

Point Location		Willow Flycatcher		Allotment			Alt S2 Occupancy Category				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Tahoe	Tahoe	16	Independence Lake	Sagehen	N	-			1		1
		17	Perazzo Meadow	Perazzo Meadows	A	Cattle			1		1
		18	Saddle Meadow	Independence	A	Cattle			1		1
		19	Gold Valley	Gold Valley	A	Cattle			1		1
		27	Sagehen Creek	Sagehen	A	Sheep			1		1
		116	Salmon Creek	Howard Creek	N	-			1		1
		117	Knuthson Meadow	Beckwourth	A	Sheep			1		1
		120	Squaw Creek	Sierra Crest	N	-				1	1
		121	Silver Creek	Sierra Crest	A	Sheep				1	1
		158	Little Truckee, Stampede Reservoir	Boca	A	Sheep			1		1
		159	Little Truckee, Boynton Mill CG	Boca	A	Sheep			1		1
		160	Little Truckee, Independence Lake	Perazzo Meadows	A	Cattle			1		1
	Tahoe Total								**10**	**2**	**12**
	Point not on NF	***15***	Carpenter Valley	Euer Valley	A	Cattle			1		1
		28	Lacey Valley	Webber Lake	A	Sheep			1		1
		30	Webber Lake Campground	Webber Lake	A	Sheep			1		1
		112	Lake Van Norden	Devils Peak	N	-			1		1
		115	Billy Mack Flat	Summit	N	-			1		1
		157	Donner Lake	Sierra Crest	N	-		1			1
	Point not on NF Total							**1**	**5**		**6**
Tahoe Total								**1**	**15**	**2**	**18**
Toiyabe	Toiyabe	9	Maxwell Creek	Hope Valley	A	Cattle			1		1
		78	Upper Charity Valley	Dressler	A	Cattle			1		1
		79	Faith Valley	Dressler	N	-			1		1
		178	Green Creek	Green Cr.	N	-			1		1
		179	Barney Lake	Eagle Cr.	N	-			1		1
	Toiyabe Total								**5**		**5**
	Point not on NF	***80***	Red Lake 1	Bamert	I	-			1		1
		161	Red Lake 2	Bamert	I	-			1		1
	Point not on NF Total								**2**		**2**
Toiyabe Total									**7**		**7**

Point Location		Willow Flycatcher		Allotment			Alt S2 Occupancy Category				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Yosemite	Point not on NF	***68***	Wawona Meadow	Chowchilla	N	-			1		1
		69	Westfall Meadow	Pinoche	N	-			1		1
		71	Hodgdon Meadow	Curtin	N	-			1		1
		180	Peregoy Meadow	Pinoche	N	-		1			1
		181	Merced River	Pinoche	N	-		1			1
	Point not on NF Total							**2**	**3**		**5**
Yosemite Total								**2**	**3**		**5**
Grand Total							**5**	**12**	**107**	**6**	**130**

Table 2. Records for the southwestern Willow Flycatcher.

Point Location		**Willow Flycatcher**		**Allotment**			**Theoretical Alt S2 Occupancy Category** [1]				
Federal Owner	**Ownership**	**ID**	**Location**	**Name**	**Status**	**Kind**	**Conditional**	**Historic**	**Occupied**	**Delete**	**Grand Total**
Inyo	Point not on NF	96	Owen's River	Buttermilk	N	-			1		1
	Point not on NF Total								**1**		**1**
Inyo Total									**1**		**1**
Sequoia	Sequoia	162	Manter Meadow	A. Brown	A	Cattle			1		1
		163	Rodeo Flat	Fish Creek	A	Cattle		1			1
	Sequoia Total							**1**	**1**		**2**
	Point not on NF Total	**172**	**South Fork Kern River**	**Bartolas**	**N**				**1**		**1**
		172	Bloomfield Ranch	Bartolas	N				1		1
	Point not on NF Total								**2**		**2**
Sequoia Total								**1**	**3**		**4**
Grand Total								**1**	**4**		**5**

[1]. *Alternative S2 occupancy categories do NOT apply to the southwestern Willow Flycatcher. As a federally listed species, it is managed more specifically by individual project mitigations and agreements from existing biological opinions with the FWS.*

Appendix E: Science Consistency Review Report

Part 1

Forest Service response to: The Science Consistency Review Report – September 29, 2003

Review of: Draft Supplemental Environmental Impact Statement, Sierra Nevada Forest Plan Amendment

Introduction

On October 2, 2003, the Pacific Southwest Research delivered a Science Consistency Review (SCR) report concerning the Draft Supplemental Environmental Impact Statement (DSEIS, June 2, 2003) for the Sierra Nevada Forest Plan Amendment (SNFPA), as requested by the Regional Forester. Overall, review team members judged the DSEIS to be generally consistent with available scientific information. There are some exceptions related to 1) completeness and documentation of bibliographic citations in the DSEIS, 2) sufficient detail in the discussion of monitoring plans, and 3) concern that the overall DSEIS in general, and the section that presented the standards and guidelines in particular, was sufficiently confusing so as to not allow a reviewer to clearly understand their intent.

Significant improvements were made in the FSEIS based on the SCR report and discussions with the Consistency Review Team. The review team's findings and the Forest Service's response are summarized in this appendix.

Background

On July 30–31, 2003, a team of 11 scientists was convened by the Pacific Southwest Research Station in Davis, CA. Its task was to evaluate the science consistency of material contained within the DSEIS and incorporated documents - i.e., the Review Team Recommendation Report and the SNFPA Final Environmental Impact Statement (FEIS) from January 2001. The team had expertise in three subject matter areas relevant to the DSEIS: fire and fuels management, forest ecology, and species viability. Following this face-to-face meeting, team members further reviewed pertinent portions of the DSEIS and provided individual comments to the review administrators, Dr. James M. Guldin from the Southern Research Station, Hot Springs, AR; and Dr. Peter A. Stine from the Sierra Nevada Research Center, Pacific Southwest Research Station.

A process for the conduct of science consistency reviews (Guldin and others, in press) guided the team's work. Team members were given copies of the DSEIS prior to the SCR meeting. At the meeting, discussions were held among the team, the technical experts and designated representatives of the Pacific Southwest Region responsible for the DSEIS, and the review administrators. The review was guided by the standardized set of science consistency evaluation criteria (Guldin and others, in press):

1. Has applicable and available scientific information been considered?
2. Is the scientific information interpreted reasonably and accurately?
3. Are the uncertainties associated with the scientific information acknowledged and documented?
4. Have the relevant management consequences, including risks and uncertainties, been identified and documented?

The scope of the initial review was limited to the DSEIS (June 2, 2003). Most reviewers were familiar with the antecedent Final Environmental Impact Statement (FEIS) for the Sierra Nevada Forest Plan (SNFP) and the FEIS was available as a reference, as needed. However, review of that document was not part of this review. A Science Consistency review of the 2001 FEIS was conducted by a team of scientists (including six members of this current team) and their comments were included in a report dated December, 2000.

Individual comments received from the 11 scientists are included in the appendix of the report. The main body of the report attempts to synthesize the comments into the categories that the team agreed captured the key scientific issues that needed attention in this review. An introductory section summarizes the main points made by the team and the review administrators over the course of the team's work.

The review team developed a number of elements for consideration at two comment levels—general comments and specific subject matter comments. Under the specific elements to review, four categories emerged and were used to structure the science consistency review:

1. fire and fuels management
2. forest ecosystem management
3. species viability
4. synthesis issues

Forest Service response to comments

General Comments on the DSEIS

Review Comment: The bibliographic citation comment captures two sets of concerns. The first is a linkage issue with the original SNFP FEIS. That document contains a bibliography, and technical experts charged with preparing the DSEIS undoubtedly referred to that original FEIS bibliography. As a result, the citations included in the DSEIS do not stand alone; in some cases it was very difficult to determine whether or not the relevant information was used because references cited in the FEIS were not carried forward and cited in the DSEIS and many citations of unpublished material were not traceable to a source or a person. The review team collectively agreed that it would be better to include a bibliography in the DSEIS in which all publications cited in the text can be listed, regardless of whether they had been cited in the 2001 FEIS. The second issue is one of omission, in that some references cited in the text of the DSEIS citations were published after the release of the EIS, and thus neither the EIS nor DSEIS included them in the bibliography. In the attached SCR tables, reviewers listed a number of citations for consideration by the technical experts. If both of these concerns are met in a revision of the DSEIS or the Final SEIS, the bibliography of the DSEIS would stand alone; reviewers thought his would be a positive outcome.

FS Response: The concept behind a supplemental EIS is not to repeat what is in the FEIS, but rather bring forward only what is new. References are cited in the DSEIS as necessary to support new information considered in the supplement without revisiting the extensive references in the FEIS.

We thank the Consistency Review Team for pointing out many new references that may be pertinent to the SEIS. The interdisciplinary team (IDT) has reviewed these papers and incorporated many of these into the FSEIS. Some other references are peripheral to evaluating the effects of the alternatives and will not be addressed specifically.

Review Comment: It was generally agreed that the DSEIS was difficult to read, and especially to interpret with respect to the standards and guides tables. Several reviewers offered specific examples of instances where it was difficult to interpret what was denoted or connoted in the entries in the standards and guides tables, and some opined that it was difficult to determine whether consistency with available science was able to be evaluated because the standards and guides tables were difficult to interpret and to crosslink. At the very least, reviewers suggested that the tables somehow denote when a blank cell carries meaning, and when it does not.

FS Response: The Standards and Guidelines are being revised for better clarity, as our other information displays in the FSEIS.

1. **Elements related to fire and fuels management.** The first specific set of elements reviewed by the team fell under the topic of fire and fuels management (noted as Element A). Concerns were raised during the SCR team meeting about six major issues related to fire and fuels management; 1) fire effects and ecology, 2) the use of SPLATs as a viable fuels management approach, 3) treatment of fuels, 4) air quality issues, 5) the use of prescribed fire for purposes of restoration of fire regimes, and 6) the use of fire surrogate treatments. Table 1 lists these elements according to the review criteria.

Key findings of the review team fall in a number of cells of the review matrix. First, there was no element in the entire science consistency review in which more reviewers found opportunity to comment than in A1, the fire effects and ecology element, in light of the first review criterion querying whether available science information had been considered. Several reviewers added specific instances of sources for additional consideration and incorporation that, in their respective opinions, would strengthen the overall DSEIS.

Review Comment: Fire effects in Sierra Nevada forests are significantly complex and merit thorough discussion of the available scientific evidence. The DSEIS is not clear on how the intended objective of restoring natural fire regimes to the Sierra Nevada will be accomplished. The linkage between fuels treatments and anticipated changes in forest function and structure leading to restoration of natural fire regimes needs detail and clarity. Uncertainty in outcomes needs to be described and subsequent management implications should be revealed.

FS Response: The Final SEIS Ch 2.1.1.a discusses Alternatives S1 and S2 sharing overarching goals for fire and fuels management that includes meeting ecological goals for re-introducing fire. Strategically placed area treatments are first designed to change landscape wildland fire behavior. Over time the goal of the treatments shifts toward restoring fire regimes and condition class across the landscape. The Final SEIS, Fire and Fuels, Ch 4.2.4 Sec B discusses the effectiveness of treatments in modifying fire behavior across the landscape which then facilitates the reestablishment of fire as a process. The use of fire as the follow-up/maintenance treatment is intended to provide for the process restoration in the treated areas.

Review Comment: The literature on strategically placed area treatments was generally viewed favorably, with only one reviewer offering a suggestion for additional literature review. On the other hand, several reviewers suggested that the uncertainty criterion fell short of consistency, largely through comments that suggested that the risks associated with that uncertainty were difficult to understand or poorly documented. Strategically placed area treatments are a theoretical concept that requires field testing to confirm the efficacy of the concept. How will the uncertainty surrounding the outcome of this management strategy be addressed? This should be discussed. Other questions about fuels treatment were tied to questions of management implications or proposed response to perceived risks and uncertainty.

FS Response: The FSEIS includes references and the points made in the report. In addition, there is substantially more information about uncertainty in the FSEIS. The SNFPA FEIS Section 1.2.4 has several discussions about a range of fuels treatment strategies. SNFPA FEIS Volume 1, Chapter 2-page 11, emphasizes the use of varying combinations of these strategies. SNFPA FEIS Volume 1, Chapter 2-page 14 includes discussions about combinations of treatments based on local manager's evaluations of the landscape and determinations of the best combinations of treatments to achieve the desired landscape fire behavior. This discussion is carried into the current SNFPA ROD on pages A-11 to A-13.

Review Comment: No elements in the overall review were as conflicting as those provided under elements A4-A6, in which the review team provided conflicting advice about whether the element was consistent with science. The DSEIS needs to more effectively present the overall fuels management strategy that includes how and when surface and ground fuels will be addressed. There is much discussion about treatment of the ladder and crown fuels through a more aggressive thinning from below strategy but little discussion about how treatments intend to address the surface and ground fuels. The roles of different kinds of fuels and their relative proportion or contribution to the fuels hazard should be more thoroughly discussed. Considering the importance of fuels treatments in this DSEIS, this topic deserves further discussion and clarification.

Related to the above issue is the implication within the proposed management direction that mechanical thinning has ecological equivalence to the physical and ecological effects of fire. Despite the practice of broadcast burning and/or pile burning of slash after mechanical treatments, there is still some important scientific uncertainty around the ecological differences of mechanical thinning and prescribed burning. The DSEIS does not do a thorough job of addressing or acknowledging this issue. There is a large research program that has been underway for several years in a number of locations throughout the United States that specifically attempts to address this issue. Although results are just now beginning to be produced, the SEIS should acknowledge what is known on this topic and discuss the implications of uncertainty.

FS Response: The Final SEIS, Fire and Fuels, Ch 4.2.4 B discusses the need for maintenance and the current assumptions about the types of treatments and the acres likely to be treated. See Table 4.2.4b. The Final has a discussion about the program uncertainties in section Ch 4.2.4. Mechanical entries are intended to set the stage for follow-up reintroduction of fire into the ecosystem under a management regime that is financially operational and that provides relative safety to people, improvements and natural resources.

The Forest Service is participating in a multi-agency nation-wide Fire-Fire Surrogate (FFS) study (www.fs.fed.us/ffs/) designed to fill the voids in our knowledge. Although silvicultural treatments can mimic the effects of fire on structural patterns of woody vegetation, virtually no comparative data exist on how these treatments mimic ecological functions of fire. Thus while silvicultural treatments can create patterns of woody vegetation that appear similar to those that fire would create, the consequences for nutrient cycling, seed scarification, plant diversity, disease and insect abundance, and wildlife are mostly unknown. Similarly, although combining managed fire with silvicultural treatments adds the critical effects of combustion, we know little about ecological effects, economics, and fire hazard reduction of these methods.

These studies have only recently been installed and no results have yet been analyzed. As these results become available, they will be considered in site specific planning and incorporated into the adaptive management framework.

Review Comment: We are also concerned about how the proposed fuels strategy is going to contend with the smoke issues. Given the need to ultimately treat so many acres with prescribed fire, even if not until second entries into stands in many cases, how will this be reconciled with smoke budget and burn day limitations? This is not an easy issue but the success of the overall fuels management strategy will require solutions to this quandary. There is some research and literature on the topics of smoke produced from wildfires, prescribed fires, and how a smoke budget may relate to a successful fuels management strategy that employs some combination of both mechanical thinning as well as prescribed fire. This available science on these topics needs to be more thoroughly revealed.

FS Response: Fuel treatments will include both prescribed burning and mechanical treatment. Alternative S2 reduces the reliance on prescribed burning as an initial treatment. This should result in less material consumed in any subsequent burns in those areas. The Forest Service is committed to work with the California Air Resource Board and local Air Districts to insure that programs are designed to insure compliance with air quality requirements and that will meet objectives in this SEIS.

2. **Elements related to forest ecosystem management.** The second area reviewed by the SCR team scrutinized elements related to forest ecosystem management (Table 2), noted as Element B. Most of the reviewers' specific comments related to element B1, the most numerous of which raised questions about whether the appropriate citations were included and whether the consequences of risk and uncertainty were appropriately established. There are still shortcomings with the articulation of pre-settlement or historic forest conditions and how this provides guidance for future management direction. Vague descriptions of desired future conditions of forests leave many questions for what managers should be attempting to accomplish.

Review Comment: A clear and scientifically defensible discussion of desired forest conditions (e.g. function, structure, composition, resiliency, etc.) that incorporates natural disturbance factors that play important and unavoidable roles in the Sierra Nevada forest ecosystems, should be presented as a preface to the proposed management strategy. Subsequently, the management strategy should be described in a manner that demonstrates how it can lead towards these conditions. Further discussions of desired forest conditions are included in the Final SEIS.

FS Response: Establishing strategically placed area treatments, using the flexibility provided with S2's Standards and Guidelines allows progress toward those goals and is described in the Final SEIS. Natural disturbances are expected to continue, in non-natural environments, for the foreseeable future on the majority of the area being considered.

Review Comment: Management towards pre-settlement conditions implies significant restoration efforts such as addressing the restoration of forest function, including fire regimes. Re-creation of pre-settlement forest structure alone will not accomplish the underlying objectives. Re-creation of pre-settlement forest stand structure may be an important management objective leading towards the desired future condition but the document should consider the restoration of pre-settlement forest function as a companion objective. This is not adequately addressed in the document.

FS Response: The SEIS Final Ch 2 discusses Alternatives S1 and S2 sharing overarching goals for fire and fuels management that include meeting ecological goals for re-introducing fire. Strategically placed area treatments are first designed to change landscape wildland fire behavior; over time the goal of the treatments shifts toward restoring fire regimes and condition class across the landscape. SEIS Final, Fire and Fuels, Ch 4 Sec B discusses the effectiveness of treatments in modifying fire behavior across the landscape which then facilitates the reestablishment of fire as a process. The use of fire as the follow-up/maintenance treatment is intended to provide for the process restoration in the treated areas.

Review Comment: The concerns about completeness of literature citation were based on whether the literature about the use of group selection silviculture in Sierra Nevada mixed conifers was completely captured. One reviewer noted several recent references that dealt specifically with this subject and that would profoundly inform the issue were not included in the discussion. The general sentiment of the team calls for more disclosure of how proposed management direction is anticipated to accomplish realization of the above stated objectives and how this will specifically contribute to the solution of identified problem issues including old forest restoration and restoration of natural fire regimes.

FS Response: The SEIS incorporates the QLG FEIS by reference for the area affected by that assessment. Implementation of group selection silvicultural systems was addressed in that FEIS.

Review Comment: Other comments raised by reviewers that fall short of science consistency reflect the question about climate change, and whether the literature and the uncertainty regarding old growth restoration and maintenance were adequately captured. Changes in future climate conditions could have important consequences for the appropriate forest conditions to manage towards as well as what the appropriate tools might be for accomplishing desired conditions.

FS Response: The final SEIS, section 3.1.1, incorporates additional discussion of climate change, its context for this plan and linkage to adaptive management.

3. **Elements Related to species viability.** The species viability issue included a number of reviewer suggestions that addressed the individual elements associated with species of concern (Table 3), noted as Element C. Element C1, pertaining to montane meadow and riparian ecosystem management and restoration, attracted the most reviewer attention within this element, largely because of the scope of the science information presented in the DSEIS, and the reviewers' feeling that assessments of uncertainty and risk were incomplete. Several reviewers suggested additional literature citations for integration into the DSEIS as background information for development of alternatives. Other reviewers suggested a more detailed explanation or provision for monitoring the effects of the alternatives in light of the risk and uncertainty associated with their proposed implementation.

Review Comment: The team made a particular point that species at risk in montane meadow systems could be addressed more effectively through a more holistic ecosystem approach. By this we mean that conservation issues for such species should be approached and analyzed by addressing physical and biological ecosystem function (e.g. through development of conceptual models that identify hydrological cycles, energy and nutrient cycles, trophic relationships, etc.), thereby understanding key ecological relationships and limiting factors that may influence population performance of species of concern. Such analyses can and should include management activities such as grazing which is identified as a key issue. We believe more effective management strategies can be developed when more thorough understanding of system function is created. The discussions on willow flycatcher and Yosemite toad in the DSEIS focused directly on some specific management concerns (e.g. effects of grazing on viability of these taxa) with little or no mention of the contextual issues of overall habitat integrity in montane meadow systems. Further elaboration on these broader issues in the decision document would help the reader understand the potential influences of the management issues on habitat integrity that are the subject of concern to the Forest Service. The proposed Adaptive Management Program includes the continuation of the Status and Change Monitoring Plan for meadows to increase.

FS Response: In addition, a "more holistic approach" could occur during landscape analysis, which is a part of S1 and S2. This approach could only be described as an analysis process, it could not be analyzed at this bioregional scale.

Evaluating energy and nutrient cycles, trophic relationships for individual meadows is not reasonable for all or most meadows and due to variability, would not likely be easily extrapolated from study sites to other meadows. This could be an area for future focused studies, but at this point are not an area of focus.

Review Comment: Several reviewers commented on specific concerns associated with the element of fisher and marten ecology and responses of those species to management. These concerns and/or comments included suggestions for citing additional literature, more thorough interpretation of the available literature, capturing the risk and uncertainty of our knowledge in the alternatives, and more clear provisions to account for potential effect of management actions in light of risk and uncertainty. Our knowledge base on fisher and marten, particularly for this portion of their range (the southern most extent for both taxa) is fairly sparse. This relative lack of information results in a relatively high degree of uncertainty regarding a number of important ecological factors related to these species in the Sierra. For example, it is unclear what habitat conditions both marten and fisher require to survive and reproduce at a rate that would sustain their population (let alone expand in the case of fisher). It is quite possible, as one member of the team has cited, that forest carnivore populations respond to elements of their habitat/environment only indirectly related to structural features of the vegetation that are being preserved. Sources of mortality that may affect population stability are also unclear. This makes it difficult to, in turn, understand how such species will respond to the proposed treatments. These sources of scientific uncertainty should be discussed in the context of risks to the population that could be increased through more aggressive fuels treatments. We do not know that proposed fuels treatments will have negative impacts on marten and especially fisher populations but the point is that we cannot be sure that they will not either.

FS Response: These are factors that will be addressed in the Conservation Assessment for Forest Carnivores. The Conservation Assessment will identify risk factors and their relative contributions to forest carnivore population stability will be assessed. The Conservation Assessment will also address areas of uncertainty and suggest methods and opportunities to gather information and knowledge.

It is acknowledged throughout the SEIS and in the FEIS that the strategically placed area treatments strategy is theoretical with limited field testing. It is also acknowledged that species information specific to the Sierra Nevada is generally lacking. The adaptive management framework of Alternative S2 will allow for adjustments to be made as more information becomes available. Several actions to increase understanding of the habitat relationship between management actions of fisher and marten are part of the adaptive management program of Alternative S2.

4. **Elements related to synthesis issues.** Several elements were grouped into a catchall category called 'synthesis issues' (Table 4). The greatest number of comments in this category dealt with concerns about the implications of climate change in regard to the Sierra Nevada, and on the possible effects of climate change on proposed management strategies. A number of additional citations were proposed for incorporation in the DSEIS that might shed more light on the potential ramifications of proposed management alternatives that will result from the implementation of the SEIS.

Review Comment: The team realizes that dealing with this complex issue of how vegetation in the Sierra Nevada may change over the next few decades due to apparent changes in temperature and precipitation is perhaps overwhelming at this stage of the planning process. However, we believe that it would be prudent for this decision document to acknowledge this phenomenon and its potential effects on vegetation communities and hydrologic cycles. There is apparently some important uncertainty associated with the outcomes of management activities when considered in light of the potential effects of climate change. It would be logical for the decision document to acknowledge these potential uncertainties and explain how they will be dealt with in the future. This acknowledgement could include a commitment, as part of an adaptive management strategy, to seek further scientific evidence on the potential implications of climate change for informing future planning cycles for both individual Forests as well as future efforts to provide management guidance collectively to all Forests in the Sierra Nevada ecoregion.

FS Response: The final SEIS and ROD addresses climate change and recognizes its role in shaping current vegetation in the Sierra and its continuing role in a highly dynamic system. The Forest Service will continue to monitor new developments, pertinent research and monitor for responses to changing climate as part of the adaptive management strategy. Changes in climate will be addressed, as well, during future planning cycles.

Review Comment: There was a separate element in this category that pertained to adaptive management (i.e. research and monitoring strategies coupled with management objectives) that enable adaptive management to proceed. A few reviewer comments were sufficiently general that the best means to summarize them was to insert them in this element. However, research and monitoring in an adaptive management context were also raised in a number of the elements already presented, especially in those instances where the concern was captured in the context of a specific resource-related element. The reviewers see the concept of adaptive management as an important institutional process to acknowledge and ultimately address those instances where science information is incomplete or contradictory. Reviewers see implementation of an adaptive management strategy as an agency response based in the concept that research and monitoring can reduce or palliate those risks and uncertainty with respect to the response of a species or resource element to a management regime. Any revision of the DSEIS should address in greater detail both the question about what level of detail is appropriate in an EIS with regard to the different kinds of research and monitoring associated with situations of scientific risk and uncertainty, and the nature of the adaptive management process that would be triggered in the event that research and monitoring reveals unintended or unanticipated effects.

This concept is the one that probably resonated most loudly amongst the members of the team. It is important that the SEIS clearly define what is intended by invoking the concept of adaptive management. There are various interpretations of what such a concept really means in practice. Part of the requirements of successful adaptive management involves at least some level of design for data collection. Depending on the question being addressed, the credibility of the information will depend on some kind of experimental design. In the face of scientific uncertainty there should be structured efforts that can produce defensible data to inform future iterations of management direction.

A final thought on the expectations of adaptive management, albeit outside the strict scope of a science consistency review. We recognize that adaptive management is difficult to execute, particularly with the scope and complexity of the problems in the Sierra Nevada. Nevertheless, beginning with a limited set of questions and a true dedication to learning, this kind of program can prove to be very valuable, both scientifically in informing management decisions and socio-politically in involving interested parties. It will require, however, dedication of sufficient resources to support the necessary efforts. We urge you not to underestimate the resources necessary to make this work successfully.

FS Response: The Adaptive Management Program in the FSEIS has been substantially revised and strengthened to address these concerns and those raised by Forest Service managers and the public.

Review Summary

Review Comment: The science consistency review of the Sierra Nevada DSEIS has not resolved all questions of whether the document is consistent with available scientific information. Upon revision of the DSEIS, efforts should concentrate on several key findings.

First, reviewers thought this DSEIS should be a stand-alone document, not tiered to the FEIS. The DSEIS bibliography should include all citations mentioned in the text, figures, and tables of the DSEIS itself. Similarly, reviewers thought a glossary specific to the DSEIS would add to its independent stature.

FS Response: By definition, the Draft SEIS is not a stand alone document. The concept behind a supplemental EIS is not to repeat what is in the FEIS, but rather bring forward only what is new. References are cited in the DSEIS as necessary to support new information considered in the supplement without revisiting the extensive references in the FEIS.

Review Comment: It may be too large a task for revision of the standards and guides tables to better inform the reader as to the meaning of entries within a cell, especially a blank entry, and to crosslink tables more effectively so as to render the document more interpretable. This is not a criticism of the science consistency of the DSEIS, but rather a point of observation that the evaluation of science consistency was made more difficult by the fact that the DSEIS is somewhat confusing. Confusion in conveying the true content of this decision document could be a significant problem for many readers.

FS Response: The FSEIS/ROD have been modified to more clearly communicate the decision.

Part 2

Forest Service response to: The Science Consistency Review Report - Supplement #1, 3 November 2003

Introduction

On November 3, 2003, the Science Consistency Review team submitted a supplement to the Science Consistency Review Report for the Draft Supplemental Environmental Impact Statement (DSEIS) submitted to Regional Forester Jack Blackwell and Sierra Nevada Planning Team staff on October 2, 2003.

Supplement #1 poses additional questions that arose during a meeting held by the Regional Forester and the Planning Team with scientists and administrators from Forest Service Research and Development on October 16-17, 2003. At that meeting, sixteen issues were identified that required further thought by the Planning Team, and there was some thought that some of those outstanding issues might benefit from further consideration of the science upon which they are founded. Upon examination of the issues, the SCR review administrators judged nine to have elements that might benefit from a second examination by the science consistency review team (Table 1), with two of those nine being condensed as one issue. The remaining issues were not included in the supplement due to: 1) not being a science issue, 2) beyond the scope of the DSEIS, 3) being referred to review by another team of scientists (California spotted owl).

Forest Service response to comments

Issues 1 and 2: NFP Condition Classes 2 and 3; Too Little, Too Slow

Review Comment: The SCR team still has concerns about the modeling that underlies the projections of change from condition classes 2 and 3 to condition class 1; that modeling should be more carefully explained. Similarly, there are expressions of caution that the SPLATs approach remains a theoretical conceptual model, and that translation to reality will require careful consideration of site-specific locations in which these SPLATs treatments are to be imposed. These arguments touch on the distinctions between science and implementation, but the team would be more comfortable if these points were more fully explained in the SEIS.

FS Response: The strategy in the SNFPA does not specifically target Condition Class 2 and 3. The strategy relies on the treatments being strategically located and, where that can be achieved by treating CC2 and CC3, it is encouraged. The treated areas will most likely result in CC1 following treatment. The proposed action reduces the emphasis on prescribed burning and increases the emphasis on mechanical treatment.

The SEIS treatment schedule will result in the treatments being completed in 20-25 years. The NFP does not require all treatments to be completed in 10 years. The SNFPA strategy is not realistically implementable in 10 years due to budget realities and the unacceptable level of impacts.

SPLATS are a strategy to change landscape fire behavior. Additional treatments may be necessary in the future. SEIS Final, Fire and Fuels, Ch 4.2.4 B discusses effectiveness of SPLATS and the treatments and the need for maintenance. Section D discusses the uncertainties about fire behavior and effectiveness.

Issue 3: 90th Percentile

Review Comment: The suggestion by the SCR reviewers on this issue is that the 90^{th} percentile figure is appropriate for most cases. But there is also comment regarding the need to reconcile the percentiles with the application of the appropriate fuels models. In terms of priority for understanding fire behavior, surface fuels and ladder fuels are more important in that they trigger crown fires. The weather standard, according the SCR scientists, was less of a critical issue in modeling fire spread than the question associated with fuels treatment, especially of surface and ladder fuels.

FS Response: We are continuing the use of the 90^{th} percentile for our standard condition to evaluate treatment conditions. The primary goal of the fuels treatment standards and guidelines is to treat the surface fuels and ladder fuels to a condition that results in acceptable levels of fire behavior. The SEIS Final discusses effectiveness, and the need for surface and ladder fuel treatment, in Fire and Fuels, Chapter 3.1.2 and the section titled Effectiveness of Fuels Treatments on Fire Behavior. Recent fires and research are cited. Ch 4.2.4 B discusses effectiveness of SPLATS.

Issue 4: Pacific Fisher Viability

Review Comment: Reviewers think that the literature suggests that fishers prefer dense, lower-elevation continuous-canopy forests with high structural diversity. Fuels treatments could affect fisher habitat, but the effects of catastrophic fires would seem to be much more damaging. The literature also suggests that the abundance and diversity of suitable prey species and den sites are just as important as vegetation structure in defining fisher habitat. Thus, the SEIS should include language related more from the more holistic view of the fisher's requirements instead of vegetation structure per se.

FS Response: It is clear that there is a strong preference by fisher for dense canopied mixed conifer forest at mid slope elevations. Unfortunately this is the area most at risk of stand replacing fire and poses the greatest threat to life and property. S2 proposes to treat approximately 25% of the landscape within 20-25 years. Treatments are more continuous around communities where risk to life and property are paramount and more patchy in old forest and other areas. This introduces or maintains heterogeneous mosaics across the landscape that provide dense patches for rest sites, den sites and habitat for a wide variety of prey while providing more open areas with lower fuel loading that will be more resilient to effects of fire. This can reduce the presumed quality of some habitat with the underlying theory that damaging effects of wildfire will be reduced at a landscape scale. At a minimum the more open patches with reduced fuel provide a hedge against stand replacing effects over a landscape by providing patches of structural diversity and green islands. These are the tradeoffs land managers have to consider.

Literature suggests that fisher are able to utilize landscapes that have more open characteristics where there is patchiness that provides high density islands (0.1 acre and larger) of suitable resting habitat (>60% canopy closure with large trees, snags or down logs. Guidelines within S2 provide for identification and retention of these kinds of habitat elements within fuel treatments in the SSFCA. Guidelines from S1 have been modified to meet realistic goals for canopy cover retention in the SSFCA and provide flexibility to treat (possibly degrade but not remove) high quality fisher habitat to achieve objectives of reducing threat to larger landscapes including communities and the majority of high quality fisher habitat that lies outside of the 25% of the landscape proposed for treatments. (This is a pretty complex issue that is hard to effectively address in 50 words or less expanded discussion follows in the background notes below).

Issue 5: Willow Flycatcher Viability; Issue 6: Yosemite Toad Viability

Review Comment: After receiving the comment from the SCR reviewers, these two issues seem closely linked in a 'montane meadow' context. Critical to the comfort that scientists have on WIFL and YT are the plans that are, or will be, put in place regarding the monitoring of populations of these species and the commitment to changes in management should that monitoring suggest population declines. There is also concern that the number of ungrazed controls for such an adaptive approach is limited and inadequate. This finds itself in the view that the available information on mountain meadow decline has neither been considered or interpreted reasonably nor have the uncertainties been dealt with properly, and also that additional research is needed to better quantify effects for these species.

Questions were also raised about the extent of the populations, and data should be cited to support the numbers of toad populations that are stated to exist.

FS Response: Alternatives S1 and S2 includes direction to monitor existing populations. Alternative S1 does not include alternative direction to be applied if local populations appear to be declining. Alternative S2 allows site-specific management plans to be developed which could adjust management activities to respond to population declines. In areas where active allotments overlap with occupied habitat, the Forest Service is proposing to initiate a number of adaptive management studies as part of the site-specific management plans. The studies will adhere to experimental design and questions about the number of controls needed and to validate results will be addressed at that time. Close cooperation with the PSW research station is anticipated throughout the life of these projects.

Factors that may contribute to mountain meadow decline are discussed generally in the FEIS (vol 2. ch. 3, part 3.4, pages 218-237). Related to these two species, the SEIS (chapter 4.2.3) and the FEIS (vol 2., ch. 3, part 3.4) discuss direct, indirect and cumulative effects of management activities of wildfire risk, wildfire recovery, timber salvage, fuel treatments, and grazing.

References to “hundreds” has been removed in reference to sites that have a history of grazing and still have YOTO occupancy. Clarification was added that some habitats may have been irretrievably lost and others have recovered or are recovering as a result of historic land management. Yosemite toad population data has not yet been collected in a corporate database. This information will be evaluated in the Conservation Assessment that is currently being prepared.

Issue 7: Adaptive Management and Monitoring

Review Comment: The scientists on the SCR review team think that several of these issues will rise and fall on the rigor of implementation of the monitoring and research program, and on the commitment by the agency to follow up with timely modification of treatments under indications that populations are being affected. Anything that the planning team could do to more precisely state how monitoring will be done and how treatments will be modified in response to monitoring will be appropriate.

There is an underlying concern that while plans can be set in place for adaptive management and monitoring, the funding to operate those plans over the long term is tenuous. In the long term, the commitment given by the Region to funding the monitoring and the execution of treatment modifications in light of the monitoring will be critical to future planning efforts as well as to the success of the current effort.

FS Response: A revised section on adaptive management in the final SEIS is a product of ongoing discussions with the PSW research station and others from the academic community who specialize in this subject area. Since the draft SEIS was issued, more work has been done to develop the specific questions to be answered and to identify the research and monitoring activities needed to address the most critical knowledge gaps. This was done in part, due to an acknowledgement of the limited funding likely to be available on a sustained basis and the need to make thoughtful decisions about the admittedly, long-term commitments some of these research efforts will entail. At the present time, the Region is spending \$2-\$3 million dollars annually on various research and monitoring efforts. The strategy in the SEIS is predicated on continuing at roughly the same level of expenditure with some redistribution of funds to initiate work on questions of most immediate concern. The adaptive management strategy is characterized by a high degree of collaboration and transparency to ensure that new information and understanding is shared widely and that changes to management direction are initiated, as appropriate.

Issue 8: Desired Future Conditions - HRCAs and OFEAs

Review Comment: The scientists reviewing this issue arrived at different conclusions; one thought that the treatments would effectively restore the old growth conditions, others thought that continued commitments to treatments would be needed that were perhaps beyond what had been indicated in the alternatives.

FS Response: The Final SEIS describes DFCs differently. It recognizes the widespread existence of large trees with intermingled patches of smaller trees. It is recognized that fire played an important role as a process, shaping the pre-settlement forest. It is assumed that prescribed fire would be used to manage surface fuel levels, especially after mechanical treatments.

Part 3

Forest Service response to: The Science Consistency Review Report - Supplement: content pertaining to California Spotted Owl, 3 November 2003

Introduction

On November 3, 2003, the Science Consistency Review team submitted a supplement to the Science Consistency Review Report for the Draft Supplemental Environmental Impact Statement (DSEIS) submitted to Regional Forester Jack Blackwell and Sierra Nevada Planning Team staff on October 2, 2003.

The supplement pertaining to content in the FSEIS on the California Spotted Owl (CASPO) was requested by the Regional Forester and his staff and was to focus on three primary topics:

- Stand structure needs of CASPO (number of big trees, degree of canopy closure, understory)
- Landscape level considerations desired to sustain owl habitat
- Desired future conditions for Protected Activity Centers (PACs); are they consistent with available scientific information.

The SCR team added two additional items

- General owl biology
- Risk and uncertainty

The review process follows the same format used for the Science Consistency Review, responding to the criteria:

1. Has applicable and available scientific information been considered?
2. Is the scientific information interpreted reasonably and accurately?
3. Are the uncertainties associated with the scientific information acknowledged and documented?
4. Have the relevant management consequences, including risks and uncertainties, been identified and documented?

The team rated each of the three elements by each of the above four evaluation criteria. A matrix was used to structure the review of the elements within the review criteria. The comments of the SCR team and the Forest Service response follow in this report.

Forest Service response to comments

General Comments

Review Comment: 1 (pg. 3) - We recommend using more references to published literature to support statements and assumptions made in the documents. Some of this material may be rehashed from years of document preparation and the original sources may have become obscured. However, it is important that facts, statements, and assumptions be linked to supporting documentation.

FS Response: More references were included throughout the Environmental Consequences section of the FSEIS.

Review Comment: 2 (pg. 3) - Overall, we believe the documents, particularly Section 4.3.2.3, could be presented more clearly. The effects analysis is inherently complex so it is important that the presentation of information be clear.

FS Response: More comparative tables and references were added to help clarify the effects analysis.

Review Comment: 3 (pg. 3) - The effects of the S2 prescription are difficult to quantify or interpret. What does retention of 40% of the basal area in the largest trees typically result in? It would be helpful to illustrate this with some examples in different kinds of owl habitat (e.g. average 4M, 4D, 5D stands). Visuals using FVS graphics of pre- and post-treatment stand structure under prescriptions for S1 and S2 for several classes of stands would be very useful for demonstrating how similar or dissimilar the treatments might be.

FS Response: The FSEIS incorporates additional visual displays and graphics to aid in the description of treatment effects. Post-treatment conditions will vary as diameter distribution varies. Stands with larger trees will have fewer residual trees as compared to stands with more medium-sized trees. Also, in stands where the diameter distribution is uneven, the post-treatment conditions may maintain higher levels of the original variation. As canopy cover is also a design criterion, differences between treated stands are not expected to vary widely.

Review Comment: 4 (pg. 3) - It would also be helpful to describe, in detail with references to published literature definitions for what is suitable owl habitat, what is suitable nesting habitat, etc. These terms are used rather loosely and it is not clear what they are intended to mean or what their significance is. Reference to the effects analysis in the SNFPA FEIS would be useful or perhaps it might be possible to incorporate some of those materials and discussions into the SEIS.

FS Response: Suitable owl, nesting, and high capability habitat have been clearly defined in the final.

Review Comment: 5 (pg. 4) - The presentation of results used to determine effects is not clear. We need clear, well-constructed tables that describes the following items:

a) total numbers of PACs and HRCAs

b) total acres of PACs and HRCAs

c) total acres of so called suitable habitat and nesting habitat

d) these above items displayed by the different land allocations

e) projected treatments in all of the above, represented in time steps

f) changes in 4M, 4D, 5M, 5D, and 6 by alternative at 20-30 years and 130 years.

g) display contributions from HFQLG versus changes on non-HFQLG forests

h) number of PACs and HRCAs that could be treated.

FS Response: The suggested tables are now incorporated in the document.

Review Comment: 5A (pg. 4) - The effects analysis is confusing and potentially misleading. You can probably make a more compelling case if you pay special attention to the spatial-temporal dynamic of the treatment strategy. Forest dynamics is a crucial issue with respect to owl (or, for that matter, any old forest dependent taxon) population persistence. In order to thoroughly understand potential effects to CASPO the reader needs to be able to assess population distribution and abundance as it may persist over space and time in response to both management manipulations as well as natural perturbations and processes that will affect forest landscape structure and function.

FS Response: In the Final SEIS, spatial and temporal effects were evaluated within the effects analysis and the results are displayed. The modeling results illustrate the effects of static treatment areas. It is expected that a more dynamic strategy will be developed before the end of the initial implementation phase.

Review Comment: 3 (pg. 4) - Short term effects of management activities are probably more relevant to owl population persistence than long-term projections in habitat change. The latter are more uncertain and will undoubtedly be subject to subsequent changes in management direction as well as unforeseen ecological circumstances. Changes in habitat conditions due to directed forest stand management and subsequent fires over the next 10 to 20 years probably results in the most relevant forces affecting owl population persistence for this analysis.

FS Response: More emphasis was added for the potential short term effects within the document. The FEIS discusses short-term impacts of the Alternatives on CASPO and has considered the tradeoffs of treatments to protect and enhance long-term sustainability of resources, species viability, and impacts on multiple resources. It is the responsibility of the Responsible Official to weigh this information and select the alternative that best balances risk, uncertainty, effects to resources, and public welfare and safety.

Review Comment: 4 (pg. 4) - Modeling appears to be a major tool used to evaluate effects. In addition to quantifying the error around outputs derived from modeling, be sure to explain the assumptions and limitations imbedded in these modeling efforts. For example, assumed effectiveness of future fuels treatments. Is maintenance of SPLATs over time assumed, even though this is not addressed? We need to understand the parameters that govern these models in order to evaluate the consequences inferred from the results. This refers to modeling used for both habitat and fire. Results for increases or decreases in both habitat and fire over time are apparently based on deterministic projections of a single set of parameter values, yielding a single estimate of future outcomes. However, all input parameters are characterized by various degrees of variation or uncertainty. Modeling should attempt to capture this variation and display how this variation might effect future projections, for example, by providing confidence limits around mean values. Without accompanying measures of variation it is not defensible to solely rely on a single deterministic projection. Assessing the effects of uncertainty might involve sensitivity analyses using full stochastic models where all parameters are allowed to vary within hypothesized ranges. Another approach might be to vary one or more parameters at a time to bound hypothesized maximum and minimum parameter values. This type of approach would provide some insight into possible maximum or minimum ranges on projected outcomes. In any case, without measures of uncertainty on model projections the use of these results will remain controversial and their use for projecting future conditions beyond 20-30 years is not defensible.

FS Response: The parameters and sensitivity of models used in analysis for the FSEIS is discussed in Appendix B-3. Risk, uncertainty and ambiguity is also analyzed and disclosed.

Review Comment: 5 (pg. 5) - Certain portions of these documents include speculations that have no scientific evidence presented in support of the assertions. For example, the document suggests that:

> Implementation of the HFQLG Pilot Project has the potential to increase the risk identified for widening gaps between habitat parcels, resulting in reduced owl densities and reduction in distribution of owls and owl habitat in AOC 1 on the Lassen National Forest. On the other hand, these actions could create conditions that maintain owl habitat longer due to the reduction in large fire potential.

Such assertions are not necessarily wrong, they simply need to be anchored to some line of reasoning or moreover, scientific reference(s) that can support the assertion.

FS Response: Assertions were anchored to scientific references where available, interpretation of statistics or were based on professional judgment when supporting documentation was not available.

Review Comment: 6 (pg. 5) - Assumptions and Limitations: We cannot find this info in the FEIS on page 82 (Volume 3, Chapter 3, Part 4.4).

FS Response: This was removed, and replaced with factors used to assess the effects of the alternatives.

Review Comment: 7 (pg. 5) - Under Outcomes and Cumulative Effects there is a discussion of the Plumas Lassen Study. This discussion should be edited to state that "In April 2003 a decision was made to restructure the design of the field work to accommodate the change in management direction that intended to allow for full implementation of the HFQLG Pilot Project. The fundamental objectives of the study were retained to the extent possible. A new study design has been prepared and full study plan development will be completed over the winter of 2003-2004.

FS Response: The suggested edit was incorporated in the final.

Review Comment: 8 (pg. 5) - It does not appear that land allocations such as OFEAs and HRCAs have any meaning under S2 because a single thinning prescription will be used, with the spatial location of treatments dictated by WUIs and SPLATs. Why retain these allocations if they are not used to guide management or used as categories to assess effects (e.g., change in amounts of 5D within HRCAs, etc.)? Do the DFCs for HRCAs or OFEAs have much meaning or utility when projects are planned?

FS Response: Under Alternative S2, the DFCs are integral to determining the individual treatment unit prescription. The desired conditions, management intent, and vegetation and fuels objectives provide direction to land managers for designing and developing fuels and vegetation management projects that are consistent with the objectives for actively managing fire and fuels, old forest ecosystems, and California spotted owl habitat. The individual fuels and vegetation management standards and guidelines in Alternative S2 are meant to be considered in concert with each other. Actual treatment unit prescriptions would be set to best meet the desired conditions and management intent of the land allocation while not violating any one of the standards and guidelines.

Review Comment: 9 (pg. 5) - The discussion regarding adjustments to PAC acreage in Section 3.2.2.3 Updated Information on California Spotted Owls requires further discussion and clarification. The gross numbers suggest a small increase in the number of PACs from 1310 to 1321 yet a 31% reduction in PAC acres (from 613,138 to 421,780) based on re-mapping efforts. The rationale for reducing PAC acres needs to be clearly explained. I assume it involves a reduction in the number and size of original SOHAs (1000 acres) that became large PACs when the PAC network was adopted plus elimination of older PACs presumed lost to fire or unoccupied. Further clarification is required as this could be a point of contention.

FS Response: This has been clarified in the FSEIS. The correction is based upon updated geographic information system maps created by the individual national forests. The reduction in PAC acres is explained to be a function of better mapping that brings the average size of PACs closer to the required size of 300 acres.

Stand Structure Needs of CASPO

Review Comment: 10 (pg. 5) - The amount and distribution of Forest Health Treatments is highly uncertain. The argument that it could be around 1000 acres per year based on current funding does not seem logical given that the universal thinning prescription would make such treatments economically feasible and therefore remove available funding limitations. These treatments were not included in the SNFPA FEIS and are not well described or quantified in the Draft SEIS. Therefore, they introduce scientific uncertainty, of some unknown magnitude, and are likely to be highly controversial. Further, they can be targeted to stand classes 4M, 4D, 5M, 5D, and 6, resulting in additional impacts on owl habitat beyond those incurred during SPLAT and WUI treatments. We suggest that this important issue be addressed and the uncertainty described and quantified.

FS Response: The FEIS now clearly describes that the acreage described in the Draft SEIS, as "forest health" treatments, is meant to include projects funded by the Forest Health Protection Staff. These types of projects may range from mistletoe reduction to chainsaw thinning in young planted stands. It is anticipated that many of the treatments affecting forest structure will likely overlap with the strategically-placed area treatments.

When the term is used in S2's desired future condition statements, it is meant to describe density reduction treatments that may be incorporated with actions taken to achieve fuel reduction. This effect is taken into consideration during the analysis. The acreage treated is not expected to be outside the modeled total.

Review Comment: 1 (pg. 6) - How will canopy cover be measured? Will there be standard methods used by all? How is the inherent error in these instruments accounted for in meeting stated objectives and adhering to prescribed limitations? Canopy cover restrictions may exceed the sensitivity of instruments available to measure the structural feature.

FS Response: Canopy cover can be measured as described in the ROD of FSEIS. There is no intent to require specified levels of precision for field measurements. Given the high level of spatial variation over even an acre, there is little to be gained by overly prescriptive requirements for either measurement or restrictions related to canopy cover.

Review Comment: 2 (pg. 6) - The SEIS could be strengthened by including a coherent, complete, updated discussion of owl habitat associations at multiple spatial scales. Verner et al (1992) summarize information on owl habitat associations. Much further discussion is also available in the SNFPA FEIS. The draft document summarizing DFCs for owl HRCAs provides an update of studies by Franklin et al. (2000), Hunsaker et al. (2000) and Blakesley (2003). Care must be taken in defining and discussing effects at multiple spatial scales. These spatial scales include: (1) the veg-plot scale (0.05-1.0 ha) defining habitat structure and composition at nest sites and foraging sites; (2) habitat associations conditions at the PAC spatial scale; (3) use of stands/veg polygons within HRCAs; and (4) composition of HRCAs. These discussions should also include the amount of variation explained in the response variables (e.g., reproduction, apparent survival, occupancy) by explanatory habitat variables.

FS Response: The spatial complexity of defining DFCs for HRCAs has been better described in the FSEIS.

Review Comment: 2A (pg. 6) - Care needs to be taken in accurately describing knowledge of habitat associations from the literature. For example, the Draft DFC for owl HRCA document citing Blakesley (2003) states that "Another important finding was a positive association for site occupancy when the nest area was dominated by large trees and >70% canopy cover." Referring directly to Blakesley (2003), she states "this means that the amount of nest area dominated by large trees and >70% canopy cover was positively associated with site occupancy whereas the amount of nest area dominated by medium-sized trees with canopy cover >70% was negatively associated with site occupancy" (page 13, first paragraph). Looking at Table 1.4 of these results (Blakesley 2003, page 23) the mean proportion of large trees with >70% canopy cover (SELCCG) in the nest areas was 24% (CV = 0.88) and that the best model explained 18% of the variation in the relationship. Clearly there is a positive and important relationship between large tree, >70% canopy cover habitat associations and site occupancy based on multi-model inferences, however, the discussion as currently presented in the draft SEIS DFC section misinterprets these results. The point here is that a coherent, precise, and synthetic updated discussion of owl habitat associations would benefit the DSEIS and provide a scientific foundation to interpret the proposed actions.

FS Response: The DFC discussion for HRCAs has been revised to correct this statement. The DFC for HRCAs in Alternative S2 is now unchanged from the DFC for Alternative S1.

Review Comment: 2B (pg. 6) - The current draft summarizes acres by habitat class cumulatively across PACs and HRCAs. It would be informative to present existing habitat within PACs and HRCAs on an individual basis. This would allow assessment of amounts and distribution of important habitat classes (e.g., 4M, 4D, 5M, 5D, 6, other). This could then be compared with projected habitat conditions within

PACs and HRCAs under S1 and S2. These data on changes in habitat composition within PACs and HRCAs, in conjunction with overall landscape changes, provides a more defensible and comprehensive base of information for assessing possible future outcomes.

FS Response: The underlying premise of both alternatives is that the spatial location of SPLATs is critical to effectively changing landscape wildfire intensity and behavior. At the bioregional scale, the method used to approximate this spatial placement of SPLATs was to apply a regular grid across the bioregion. This is clearly understood to not represent expected actual areas of SPLAT implementation. Direction in Alternative S2 includes a strong emphasis to avoid PACs when designing treatments at the project level and to design prescriptions to consider the desired condition of HRCAs. An evaluation of projected effects to individual PACs and HRCAs based upon the bioregional modeling would not be meaningful in assessing how actual projects might be implemented. The aggregate evaluation used provides a reasonable estimate of potential effects to PACs and HRCAs across the bioregion. Effects to individual PACs and HRCAs would be fully evaluated during site-specific project planning and cumulative effects across the bioregion would be assessed by implementation monitoring.

Review Comment: 2C (pg. 7) - Although existing research results indicate that canopy cover is important for owls there are some important uncertainties that should be acknowledged. Threshold tolerances for canopy cover have not been established. It is uncertain how much of each habitat class is required within HRCAs to provide for high survival and replacement level reproduction.

FS Response: This information has been reflected in the discussion of DFCs for HRCAs

Review Comment: 2D (pg. 7) - Results from observational studies to date provide recommendations but we are uncertain regarding amounts of habitat by structure class that are necessary to provide for high survival and replacement-rate reproduction. Analyses to date have been based on habitat composition within circles centered on owl nest areas. These circles function as surrogate measures of HRCAs. However, we have little information on how owls use habitat within HRCAs and what are the critical amounts, types, and distribution of habitat within HRCAs required for high survival and reproduction. Until further research is conducted the results from observational studies and descriptions of habitat associations provide the best available scientific information.

FS Response: This information has been reflected in the discussion of DFCs for HRCAs.

Review Comment: 3 (pg. 7) - Results reported in the effects analysis suggest S1 maintains only slightly more canopy cover after 30 years than S2 would. How was this determined? If this includes factoring in canopy cover expansion after thinning treatments then that should be discussed, quantified, and linked to scientific sources that have documented this. Surely there is some response in the canopy of trees that are retained after thinning so this should be explained and linked to references that support this notion. Again, a much more clear presentation and discussion of results is required.

FS Response: Canopy cover, as an average for the entire analysis area, varies only slightly between S1 and S2. The crown expansion of residual trees is included in this average. We have not described stand-by-stand canopy cover changes. In general, the treatment area canopy cover, assuming maintenance, is not expected to vary significantly over time.

Landscape level conditions desired to sustain owl habitat

Review Comment: 1 (pg. 7) - The scientific rationale for using different time frames for analysis is not clear. For example, quantifying loss of PACs over an eight year average (as opposed to any other time frame) was not explained. There is significant annual variation in variables such as fire extent so it would strengthen the analysis to be more purposeful in establishing time frames for analysis.

FS Response: The analysis of fire effects on PACs has been revised to clarify the analysis conducted and the conclusions drawn. The timelines chosen reflect the availability of reasonable data for analysis. Wildfire effects to PACs is evaluated from 1993-2002 because 1993 was the year when PACs were formally identified. The effects of wildfires on PACs in recent years is limited to 1999-2002 because data on the status of individual PACs was available for fires during that timeframe. The annual average rate of PAC damage or loss from recent wildfires is presented to provide an indication of potential losses should the current trend in large, high intensity wildfires continue.

Review Comment: 2 (pg. 7) - The modeled changes in CWHR type as a result of treatments over time could benefit from presenting more of the "raw" data. The only table presented shows absolute differences in acreage in different CWHR classes between S1 and S2 in 20 year and 130 year time steps. This presumes that this is all one needs to know to evaluate effects. Presentation of more raw information, as suggested above in constructing well-designed tables about where and when treatments will go and allowing the reader to evaluate might be more effective. The modeling outputs, especially after 130 years, are fraught with assumptions that are not fully revealed.

FS Response: The suggested tables are now incorporated in the final and assumptions are more clearly explained.

Review Comment: 3 (pg. 7) - The "Geographic Areas of Concern" have some significance in terms of maintaining the distribution of birds and in facilitating dispersal across relatively constraining geographic barriers. The description of effects to these areas, specifically AOC 1, 2, and 3, is rather vague and needs to be quantified. Saying "small portions" of an AOC is located on Forest Service lands or the "majority of this AOC is in private ownership" makes evaluating effects difficult. The potential effects were apparently address in the HFQLG EIS BE but are not discussed here nor put in context of the entire Sierra. This discussion should be expanded to include current habitat conditions in all AOCs, management within AOCs, and projected habitat conditions in 20-30 years. Does S1 or S2 result in improved habitat conditions for owls within AOCs?

FS Response: AOCs are more thoroughly addressed in the document. There are no special management directions for activities within the AOCs.

Review Comment: 4 (pg. 8) - Under the discussion of "Retention of Duff Layer" it states that "S2 has a slightly greater potential for disturbance of the total duff layer and associated micro-habitat that might be important to spotted owl prey." What is the scientific basis for making this assertion? How do we know it more or less than S1 and what is the significance of any disturbance of the duff layer?

FS Response: This was more thoroughly discussed and anchored to science within the document.

Desired future conditions for Protected Activity Centers

Review Comment: 1 (pg. 8) - The section on "acres of mechanical vegetation treatment" states that entry into PACs is discouraged and it also states that "replacement acres" would be applied to PACs to replace acres disturbed through management actions. In concept this makes sense but it is hard to evaluate how this might manifest itself in practice. Presumably this evaluation must assume that the maximum number of acres will be entered. It is difficult to know what, if any, suitable acres will be available to "replace" acres that are treated.

FS Response: The replacement acres concept and reference has been dropped from the document. PAC boundaries would be assessed at the project level, and if appropriate boundaries may be adjusted.

Review Comment: 1A (pg. 8) - It would be useful to discuss the utility of PACs; what is their purpose, do we expect them to be permanent features, are certain locations inherently suitable for long term habitat value, how do PACs mesh with longer term forest management strategies that acknowledge and provide for dynamic forest conditions over time and space, etc. Furthermore, how will Forest Service policy provide for subtle to more significant shifts in actual PAC configuration that results from changes in landscape conditions and/or selection by individual pairs?

FS Response: The FEIS and FSEIS present a short-term strategy for fuels and vegetation management. PACs are a component that fit with this short-term strategy just like they did in the FEIS. A long term strategy for PACs was not presented in the FEIS and is not addressed in the FSEIS.

General Owl Biology

Review Comment: 1 (pg. 8) - The discussion of the owl population trends in Section 3.2.2.3 slightly misinterprets the findings in the CASPO meta-analysis. The sentence "However, the capture-recapture methodology is not statistically different than $\lambda = 1$, which would indicate a stable population." suggests a conclusion that is not shared by the authors in the meta-analysis report. In Franklin et al. 2003, the authors state that there are still uncertainties in interpreting λ for various reasons, including such factors as source sink population dynamics, most point estimates of λ were < 1, and relatively low apparent adult survival rates on four of the five study areas that could be the most crucial measure. We recognize that the draft documents you have prepared also acknowledge (in fact immediately after the above cited statement) the uncertainty around rangewide population trends. Nevertheless, given the careful scrutiny that this subject matter will be subject to in the final review of the documents we recommend very careful treatment of the interpretation of findings and full disclosure of the complete facts.

FS Response: This clarification is incorporated into chapter 3.

Review Comment: 1A (pg. 8) **-** The group of scientists who authored the meta-analysis report stated that the selected demographic study areas cannot be considered representative of owl demographic trends throughout the Sierra Nevada. There are various sampling design factors that explain this conclusion, some that are stated in Section 3.2.2.3 and others including non random selection of study areas. However, the authors further conclude that the extant population studies span a major latitudinal gradient over the range of this subspecies and each of the five study areas had unique characteristics that capture much of the inherent environmental variation within the California spotted owl range. We suggest that it is important to include these additional details in explaining the degree to which inferences can and should be drawn from these data.

FS Response: This clarification is incorporated into chapter 3.

Review Comment: 2 (pg. 9) - The citation of Stein (sic) pers. comm. in Section 3.2.2.3 should be replaced by Franklin et al. 2003.

FS Response: The suggested change has been incorporated in the FEIS.

Review Comment: 3 (pg. 9) - Throughout this document point estimates for one variable or another (often derived from modeling exercises) are presented but almost always there is no error estimate provided for these data. It is very difficult to interpret the significance or meaning of these data without error estimates or confidence limits to describe the uncertainty around these estimated values.

FS Response: It was identified within the FSEIS that the modeling is only an estimate, and that it should be considered as such. Uncertainty around these estimates has been addressed within the document.

Review Comment: 4 (pg. 9) **-** In the same vein as the above comment, there are many instances where vague descriptive terms are used, e.g. "general increase" or "moderate probability", to characterize habitat changes due to treatments. These vague terms make it very difficult if not impossible to interpret the significance of the statement that is being described.

FS Response: More estimated numbers and comparisons were incorporated in the FSEIS.

Review Comment: 4A (pg. 9) **-** There are also many instances where quantified estimates of, for example, change in habitat conditions such as number of large trees after 20 years, are presented without any explanation of how these estimates were derived. If these are important statistics, meaningful in terms of revealing the anticipated impacts (or lack thereof) of alternative treatments, we need to have confidence in these estimates. We need to understand what the scientific underpinnings of these estimates are.

FS Response: Descriptions as to the importance of special attributes and references were added to the document.

Review Comment: 5 (pg. 9) - In the discussion on snags and down wood, it appears that retention requirements are intended to reflect per acre numbers but this is not stated as such.

FS Response: The reference to snags/acre was added to this section.

Risk and Uncertainty

Review Comment: 1 (pg. 9) - The conclusion (Outcomes and Cumulative Effects – Section 4.3.2.3) states that it is uncertain what the long-term effects would be under either Alternative S1 or S2. As described throughout the preceding discussion, the SEIS would greatly benefit from a more coherent and complete presentation of expected results on which to assess possible outcomes over the short and long terms. Alternative S2 likely incurs greater risk to owl persistence because of: (1) potential to treat more PACs (51% of total PACs); (2) canopy cover reduction in PACs (3) more aggressive vegetation treatments compared to S1 (lower canopy cover retention, increased harvest of mid-sized trees <30" dbh); (4) full implementation of HFQLG; and (5) unquantified amounts of Forest Health treatments. Given continued concern regarding owl population trends Alternative S2 likely incurs greater risk. This makes it critical that a defensible adaptive management program is an integral part of implementation in order to address key uncertainties. Currently, the adaptive management program is not defined and there is scientific uncertainty regarding whether or not a valid program will be developed to accompany the greater risk perceived with Alternative S2.

FS Response: More emphases and discussion on short-term effects and associated risk was added to the FSEIS and is considered in the Adaptive Management process.

List of Preparers

The following is a list of contributors to this draft supplemental environmental impact statement. Numerous other people have also contributed in many ways to this document. Their help is greatly appreciated.

Interdisciplinary Team

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Dr. Ahuja is currently a Province Air Quality Specialist for the Forest Service supporting air program for the eight northern national forests in California. He has worked for the Forest Service for twenty years in the Southwest and Pacific Southwest Region in various positions. He holds a Ph.D. from the University of California at Davis. He also has Air Quality Certification from University of California (Extension) Davis. He has written various technical documents and papers for Forest-wide and Region-wide use.

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Currently Wildlife and Range Program Leader, Sequoia National Forest. B.S. in Range & Wildlands Science from UC Davis 1979. Twenty-four years experience in range & wildlife management with the Forest Service.

Berni Bahro - Fire/Fuels Specialist

Berni received his A.S. in Forestry from the University of New Hampshire’s Thompson School of Applied Science in 1979. He graduated in 1989 with a B.S. in Science Education from Oregon State University. In 1993 he graduated from Technical Fire Management, an advanced study program in Wildland Fire Science that is accredited through Colorado State University. Berni has been working for the U.S. Forest Service for 23 years, with twenty years in wildland fire suppression. Berni was the District Fire and Fuels Specialist on the Placerville Ranger District, Eldorado National Forest. and is currently an Assistant Regional Fuels Specialist – Planning He has worked in three regions, on three National Forests and at a Forest Service Experiment Station. He also participated in the Sierra Nevada Ecosystem Project as an Associate Contributor and co-authored two publications.

William A. Baker - Environmental Coordinator/Forester

Bill received a BS degree in Forest Management from the University of California, Berkeley. His positions in the Forest Service include five years on the Mendocino NF in timber sale preparation, four years on the Stanislaus NF in sale administration, five years on the Klamath NF as resource officer, and three years in timber management and 20 years in planning and environmental coordination on the Tahoe NF.

Dave Bakke - Region 5 Pesticide-Use Specialist

Since 1999, the Region 5 Pesticide-Use Specialist, responsible for review and direction of pesticide uses in the region. BS, Forestry, UC Berkeley. 24 years experience with the Forest Service. Completed the Region 5 Advanced Course in Forest Ecology and Silviculture in 1983. Certified R5 Silviculturist since 1986. Completed the Forest Service National Advanced Pesticide Management Training course in 1991. From 1978 to 1998, on the Eldorado National Forest, with last fifteen years as a silviculturist, at both the District and Forest level. Since 1991, involved in the completion of NEPA planning documents involving herbicides, including the writing of site-specific herbicide risk assessments. In current position, have been involved with appeals, litigation, NEPA input, and technical article review and writing involving pesticides.

Klaus Barber - Analysis Core Team Coordinator

Education: BS in Forest Management from University of California, Berkeley and an MBA from University of Southern California. Experience: Klaus has 34-years with the Forest Service as District Timber Management Officer, Timber Planner, Forest Land Use Planner, Regional Biometrician, and presently Regional Operational Research and Management Science specialist. He has worked on special projects, such Redwood Park Expansion, Gang-of -Four Spotted Owl-Fisheries Analysis, FEMAT, and Cal Owl. He is the co-developer of CIA, ELMO, and RELM computer models.

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Teresa has a BS degree in wildlife biology. She has worked in wildlife for 15 years; with the Forest Service for 13 years.

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Anne Bradley has been the Regional Botanist for the Forest Service Pacific Southwest Region for five years. Prior to this, she was a specialist in land management planning and administrative appeals for the Regional Fish, Wildlife and Rare Plants staff. She also worked on the original Sierra Nevada Framework EIS Interdisciplinary team, as well as the EIS science and monitoring teams. Before coming to the Pacific Southwest Region, she was a botanist/plant ecologist at the Forest Service Fire Sciences Laboratory in Missoula, Montana. There she participated in fire effects research studies throughout the northern Rockies and intermountain west. Anne has a Bachelor’s degree in biology from Colorado College and a Master’s degree in botany from the University of Montana.

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Doug received a B.A. degree in Biology from Whittier College, 1991 and a M.S. degree in Resource Conservation in the School of Forestry from The University of Montana, 2001. He is currently working for the Humboldt-Toiyabe National Forest as a zone wildlife biologist on fuels reduction projects along the eastern front of the Sierra. He is also one of the editors of Great Basin Birds published the by Great Basin Bird Observatory.

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Lisa has worked as a soil scientist for the last 14 years. She is currently in the Region 2, Regional Office. Prior to that she was the Forest Soil Scientist on the Inyo National Forest and has also worked in Sacramento for US Bureau of Reclamation (1992- 1995), the Tahoe National Forest (1989-1992), and for the Plumas National Forest (1988). She has a MS Soil Science from University of California, Davis and a BA in General Agriculture from Washington State University.

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Mike has bachelors and masters degree in biology from CSU Fresno. He has been the Regional Foresters Representative since 1991.

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Bachelor of Science degree in Forestry from Michigan State University, 1972; Masters of Science degree in Resource Economics, Michigan State University, 1973; Regional Director, Ecosystem Planning, Pacific Southwest Region (1991-Present); Assistant Station Director, Planning and Application, Pacific Southwest Forest and Range Experimental Station, (1988-1991). Other work includes: ID Team Leader, Regional Guide; RPA Coordinator; and NEPA/Appeals.

Joanna Clines - Botanist

Joanna has Bachelor of Arts degree in biology from California State University, Fresno. She earned a Master of Arts degree in plant ecology from CSU Fresno, and completed a thesis on the reproductive ecology of the rare shrub *Carpenteria californica*. Prior to joining the Forest Service as a seasonal botanist in 1988, Joanna gained experience in wildlife and fisheries biology working for California Department of Fish and Game and Kings River Conservation District, and in botany with the California Energy Commission. Joanna has worked as the Forest Botanist for the Sierra National Forest for 10 years. Other duties on the Sierra National Forest include coordination of the noxious weed program and the research natural area program.

Ann Denton - District Ranger

Ann received her B.A. in Economics with Honors from Stanford University in 1972. She received her M.S. in Agriculture, with an emphasis in Soil Science, with Honors from Cal Poly San Luis Obispo in 1978. She has worked for the Forest Service for 25 years on the Lassen, Plumas, Eldorado, Shasta-Trinity, and in the Regional Office, before settling in as District Ranger at Mi-Wok Ranger District on the Stanislaus National Forest for the past 12-1/2 years. Her previous positions include Soil Scientist, Timber Sale Administrator, Communications Specialist, Management Analyst, and Assistant District Ranger.

Thomas Efird - Sierra Nevada Framework Implementation Team Leader

Currently works with R5 Regional Staff Directors and Forest Supervisors to review and recommend changes to current management policy to improve implementation of the Sierra Nevada Framework on the 11 affected national forests. Tom has served on 4 different Sierra Nevada national forests over the past 26 years in various positions including 12 years as a District Ranger. He received a BS in Business Administration from California State University - Fresno and a BS in Forestry from University of California – Berkeley. Tom is California State Registered Professional Forester # 2052 and Society of American Foresters Certified Forester # 2396. He was formerly a certified silviculturist and served on the Sierra Nevada Framework Management Review team.

Steve Eubanks - Forest Supervisor

BS in Forest Engineering from Oregon State. Transportation Planner on Mt. Hood Forest, Project Planner on Estacada District, Mt. Hood (west side Cascades); Tmbr Mgmt Assistant, Tieton District, Wenatchee NF (east side Cascades); District Ranger, Bear Springs RD, Mt Hood (east side Cascades); District Ranger, Blue River RD, Willamette NF (west side Cascades); Leader, National Recreation Strategy, Rec, Wilderness, Heritage Staff in WO; For. Supvr, Chippewa NF, Minnesota; For. Supvr, Tahoe NF. Significant interaction with Ecosystem Researchers, starting at Tieton District and continuing to present, but maximized during my Blue River Ranger job because HJ Andrews Exp. Forest located on that district. Our work was foundation for a lot of developments in forest ecosystem mgmt in the west. Extensive experience in prescribed and wildland fire.

Gary Fildes - Forest Fuels Specialist

Gary Fildes is currently the Forest Fuels Specialist for the Tahoe National Forest. Since 1975 he has worked on three Forests and in the Regional Office in various fire prevention, fire suppression, and fuels management positions. He received a BS degree Natural Resources with an emphasis in Watershed Management from Humboldt State University in 1975.

Jo Ann Fites-Kaufman – Ecologist

Jo Ann has a PhD in Forest Ecosystems at the University of Washington, a M.S. in Forest Resources at the University of Georgia, and a B.S. in Biology at Humboldt State University. She has worked for the Forest Service for 13 years as a botanist, vegetation ecologist and fire ecologist in northern California.

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Mike has a B.S. in Wildlife Management from Humboldt State University. He is the Forest Service liaison to the U.S. Fish and Wildlife Service. He has also worked as a district biologist on the Umpqua National Forest and zone biologist on the Idaho Panhandle NF and served as Klamath Province FWS/FS liaison for implementation to the Northwest Forest Plan. He is the Acting Regional TES Program Manager. He has been with the Forest Service for 29 years.

Dave R. Gibbons - Director Ecosystem Conservation Staff

Dave has spent the last 28 years working for the Forest in varying capacities. First, as a Forest fisheries biologist and resources staff on the Tongass National Forest in Alaska, and next as the Regional Program manager for fisheries in the Pacific Southwest and Alaska Regions. After the Exxon Valdez oil spill in March 1989, he worked for 2 years as the Forest Service representative on the Department of Justice intertidal damage assessment studies, nest as the first Restoration Director of the Exxon Valdez Restoration Program for 2 years and for four remaining years as the Forest Service representative on restoration team and Exxon Valdez Trustee Council. From 1998 to 2003, he held the position of Forest Supervisor the Chugach National Forest and since early 2003, as the Director of the Ecosystem Conservation Staff for the Pacific Southwest Region. Dave has authored many papers dealing with land and aquatic resource management issues including his doctoral dissertation on streamside and aquatic habitat risk assessments. He has a B.S. Degree from the University of Washington in Fisheries, an M.S. Degree from the University of Connecticut in Water Quality/Fisheries and a Ph.D. in Fisheries from the University of Washington.

Michael I. Goldstein - Wildlife Ecologist

Mike Goldstein holds a B.S. in Wildlife Biology from Colorado State University, an M.S. degree in Environmental Toxicology from Clemson University.

Mary Grim - Fisheries Biologist

Mary received her B.A. in Biology from West Virginia University in 1993, and completed graduate course work at Virginia Polytechnical Institute and State University. She has worked as the West-Zone Fisheries Biologist on the Tahoe National Forest since 1999. Prior to that, she worked as a Fisheries Biologist for the National Marine Fisheries Service and for the George Washington National Forest.

Kathy Hardy - ID Team Coordinator

Kathy has been the District Ranger on the Placerville Ranger District of the Eldorado National Forest for four years. Prior to that, she was the District Ranger in Leadville, CO. She has worked for the Forest Service since 1980, on eight National Forests in Oregon, California, Idaho, Wyoming and Colorado. She has a BA in Anthropology from the University of Virginia. The employees of the Placerville Ranger District have completed planning and begun implementing three fuels treatment projects in the wildland urban intermix following the direction contained in the record of decision for the Sierra Nevada Forest Plan Amendment. One of these projects is a national pilot project for the Healthy Forests Initiative.

Richard Hatfield - Writer/Editor

Richard Hatfield is currently a writer/editor on the Inyo National Forest in Bishop, CA. He has worked for the Forest Service and National Park Service for the last six years in various positions. He holds a MS in Land Use Planning from the University of Nevada, Reno. He also has a BA in Sociology from the State University of New York at Geneseo.

Carol A. Kennedy - Forest Soil Scientist

Carol graduated from Cal Poly San Luis Obispo. She has worked for the Bureau of Land Management, Soil Conservation Service and the Forest Service. She started working for the Forest Service in 1989 as a soil scientist on the Tahoe National Forest. Carol is currently Forest Soil Scientist and Watershed Program Manager on the Tahoe National Forest.

John Kliejunas - Regional Forest Pathologist

Masters of Forestry degree, University of Minnesota; Ph.D. in plant pathology, University of Wisconsin, Madison. Seven years research experience on native forest decline, University of Hawaii. Forest pathologist, State and Private Forestry staff, in Pacific Southwest Region since 1979. Regional forest pathologist since 1986.

Mark Lemon - District Fire Management Officer-Fuels

Mark is currently working as a District FMO-Fuels. He is a 1997 graduate of Technical Fire Management. He has worked for the Forest Service in various fire/fuels management positions since 1975.

Julie Lydick - Assistant Director of State and Private Forestry

Julie completed a Bachelor of Science degree in Natural Resources Management - Forestry from California Polytechnic State University, San Luis Obispo in1978. She has twenty-four years with the Forest Service working on forests in the Sierra Nevada with assignments in timber sale contracting, environmental planning, as district ranger, and forest resource staff officer. In her current assignment she is responsible for forest health protection programs throughout the Pacific Southwest Region.

Tina Mark - Wildlife Biologist

Tina received a B.A. degree in Zoology from U.C, Berkeley in 1978. She is currently the Assistant Forest Biologist on the Tahoe NF. Tina began her career in wildlife biology with the Forest Service in 1980. In addition to wildlife biology, Tina has worked in the fields of range, timber, and sensitive plants. She has worked on the Inyo NF, R-5 Regional Office, Humboldt-Toiyabe NF, and the Tahoe NF. She has been on the Tahoe NF since 1995.

Anthony Matthews - Forest Land Use Planner

Bachelor of Science degree in Forestry from North Carolina State University, 1977; Masters of Science degree in Forest Management from Colorado State University, 1981; Forest Land Use Planner and Land Management Planning Specialist, Plumas National Forest (2000 - present); Forest Plan Implementation and Monitoring Forester, Idaho Panhandle National Forests (1991 - 2000); Timber Management Staff Officer, Sandpoint Ranger District (1988 - 1991); Regional Timber Appeals Specialist, Pacific Southwest Region (1986 - 1988); District ID Team Leader, Troy Ranger District (1984-1986); District ID Team Leader, Red River Ranger District (1981 - 1984).

Gary Milano – Wildlife Biologist

1994-Present: Wildlife Biologist, Inyo National Forest
1979-1994: Biological Technician (Wildlife) Bend Ranger District, Deschutes National Forest, OR
1977-1979: Wilderness Ranger, Beartooth and Washakie Wilderness Areas, Shoshone National Forest, WY
1976: Biological Technician (Wildlife), Lander Resource Area, Bureau of Land Management, Lander, WY
1975: Biological Technician (Wildlife), White River Resource Area, Bureau of Land Management, Meeker, CO
1974: B.S. Degree, Wildlife Management, University of New Hampshire.

Kathleen Morse - Interdisciplinary Team Leader

University of Montana, B.A. Natural Resource Economics
Graduate work at University of Washington School of Marine Affairs
Research Specialist - Battelle Pacific Northwest Laboratories 1988-1989
Operations Research Analyst - Modoc National Forest 1989-1991
Regional Economist, Lead Staff to Governor's Timber Task Force - Region 10 1991-2000
District Ranger - Inyo National Forest 2001-present
Team Member - Sierra Nevada Forest Plan Amendment Review Team, 2002

Richard Perloff - Wildlife Biologist

B.S. Biology 1982; Lewis and Clark College, Portland OR. Five years experience in field research on a number of vertebrate species. Fourteen years experience as a Forest Service wildlife biologist.

Laurie Perrot – Natural Resource Specialist

B.S. in forestry, University of California, Berkeley. Work Experience: Writer/editor for the Sierra Nevada Forest Plan Amendment Draft and Final Environmental Impact Statements and the Herger-Feinstein Quincy Library Group Forest Recovery Act Supplemental Draft Environmental Impact Statement. Laurie worked on the Plumas National Forest as a NEPA Planner for 10 years, preparing environmental analyses and leading interdisciplinary teams. She spent 4 years with the U.S, Environmental Protection Agency Regional Office in San Francisco as an environmental specialist in the pesticides regulatory program.

Brent Roath - Forest Soil Scientist

Brent has a B.S. in Soil Science from Oregon State University. He has a total of 26 years experience as a Soil Scientist on the Angeles, Boise, Six Rivers and Sierra National Forests. He has been on the Sierra National Forest since 1987.

Cindy K. Roberts - Wildlife Biologist

Cindy Roberts has an Associate degree in Animal Science from Yuba College, and a Bachelor of Science degree in Biological Sciences and a Masters degree in Wildlife Conservation from California State University Sacramento. She has been working for the USDA Forest Service for 12 years on two different forests within Region 5. As a District Biologist, Cindy has managed Wildlife, and as positions changed, Botany and Fisheries responsibilities as well. Cindy's duties have also included Forest Fish and Wildlife Program responsibilities and Acting Forest Wildlife Biologist.

Gary Rotta - Wildlife Biologist

Gary holds a Bachelor of Science in Wildlife Management from Humboldt State University. He has worked as a Forest Service Wildlife Biologist on the Plumas National Forest since 1978. Gary is responsible for program planning and budgeting, project coordination, planning, implementation and monitoring for wildlife issues on the Mt. Hough Ranger District. He is currently an Associate Faculty Instructor for Introduction to Fisheries and Wildlife at Feather River Community College in Quincy, California.

Joanne Roubique – ID Team Coordinator

Joanne is currently a District Ranger on the Truckee Ranger District of the Tahoe National Forest. Prior to this assignment she was a Landscape Architect on the Tahoe NF.

Joe Sherlock - Silviculturist

Joe received his Bachelor of Science degree in Forest Resource Management, from Southern Illinois University, in 1977. He worked on the Shawnee National Forest from 1977 to 1978, collecting forest inventory data in contribution to Forest Plan development. During 1978 to 1979, he worked in Wyoming for the USDI Bureau of Land Management, performing a wide range of forest management tasks. In 1979, he was assigned to the Stanislaus National Forest, Mi-Wok Ranger District. He has been involved with all aspects of forest management, leading to the current position of Resource Management Program Area Leader. He gained Certification as a Silviculturist in 1983 and became a Regional Forester Representative for Silviculturist Certification in 1990. He has been a member of the Society of American Foresters since 1974.

Dave Smith - District Silviculturist

BS, Forest Management, Oregon State University, 1970. Completed the Region 5 Advanced Course in Forest Ecology and Silviculture in 1977. Certified R5 Silviculturist since 1978. California Registered Professional Forester. Sale Preparation Officer on the Six Rivers and Sierra National Forests 1970 to 1978. District Silviculturist 1979 to present on the Sierra National Forest. Completed numerous fire suppression and prescribed fire management courses and assignments. Qualified in a number of wildland fire suppression and prescribed burning positions.

Sheri Smith - Supervisory Entomologist

Sheri graduated with a B.S. in Biology and Entomology in 1986 from Utah State University, Logan, UT. Graduated with a Masters in Entomology and Statistical Analysis from Utah State in 1988.

Started working for the Forest Service in Ogden, UT in 1988. Transferred to Redding, CA with the Forest Service in 1990. Worked as an entomologist covering northwestern CA for 1 year and then transferred to Sonora, CA in 1991. Worked as an Entomologist covering the Southern Sierra Nevada through 1994. Transferred to Susanville, CA in 1994. Currently, she works for the State and Private branch of the Forest Service and is the Supervisory Entomologist and Forest Health Protection Specialist covering northeastern CA.

Brian Staab - Regional Hydrologist

Brian has been Regional Hydrologist for the Forest Service, Pacific Southwest Region since 2001. He earned a B.S in Civil and Environmental Engineering from the Pennsylvania State University and a M.S. in Environmental Fluid Mechanics and Hydrology from Stanford University. Prior to the Forest Service, he worked for NASA for 10 years managing water quality, wetlands, soil and groundwater remediation, environmental impact assessment, and endangered species programs. Brian has also conducted research on macro-scale hydrologic processes in large forested basins.

Phil Strand - Fisheries biologist

Phil has been Fisheries Program Manager for the Sierra and Sequoia National Forests since 2000. He has a B.S. in Forest Sciences from University Washington and has been with the Forest Service for 26 years.

Andy Taylor - Forest Analyst

BS and MS Forest Management from Michigan State University.
Forest analyst for the Mendocino NF since 1980.
Member of the Cal Owl EIS team.
Member of the analyst core team for the SNFPA and SNFPA review.
Forest GIS coordinator for the Mendocino NF since 1995.

Gary Thompson - Fuels Coordinator

Gary is currently in the Region 5, RO as the Fuels Coordinator. He has 30 years in the Forest Service. He was on the Sierra NF from 1979-2002 as the District Fire Management Officer, TMO, and Silviculturist. He was certified in Region 5 as a Silviculturist in 1977.He received a BS in Forestry from Humboldt State University in 1974.

Denise Tolmie - District Fuels Specialist

Denise is currently working as a District Fuels Specialist, with main emphasis of work including planning and implementation of prescribed burns, brush disposal and cooperative projects with district vegetation management department. She graduated in 1984, with an Associate of Science degree in Forestry, attended UC Berkley and Humboldt State University to obtain the qualifications for the Professional Forester series and is a 1997 graduate of Technical Fire Management. She has worked for the Forest Service in various fire/fuels management positions since 1983.

Craig Wilson - Wildlife Biologist

Craig graduated with a B.S. degree in Wildlife and Conservation Biology from the University of Nevada Reno. Craig is currently the District Wildlife Biologist on the Sierraville Ranger District of the Tahoe National Forest. Craig has worked as a wildlife biologist with the Forest Service for eight years.

Kenneth A. Wright - Forest Analyst

B.S. in Forest Science, M.S. Watershed Management Humboldt State University. Experience: Ken has 26-years experience with the Forest Service as Planning Hydrologist, District Soils Scientist/Hydrologist, Forest Planner, and is currently the Forest Analyst on the Six Rivers National Forest (1992 to Present). He has worked as an analyst on the Six Rivers National Forest Plan, Northwest Forest Plan, California Spotted Owl Plan, and the Herger-Feinstein Quincy Library Group EIS.

Don Yasuda - Assistant Resource Officer/Wildlife Biologist

Don is currently on the Pacific RD, Eldorado NF He has 16 years experience as a Wildlife Biologist, all at Pacific RD (1987-present) He received a B.S. degree, in Wildlife and Fisheries Biology, from UC Davis, in 1987 He is a Certified Wildlife Biologist, a member of The Wildlife Society a Region 5 representative on the California Interagency Wildlife Task Group (2002-present) the Region 5 co-representative (1999-present) and National co-chair (2003-present) on the Natural Resource Information System (NRIS) Fauna module User Board.

Project Support

Gary Chase - FSEIS Layout

Gary has an A.A. degree in Forestry from Lane Community College in Eugene Oregon. He has worked for the Forest Service for 29 years; mostly on the Shasta-Trinity National Forest. His current work revolves around web site development and document publishing.

Monica Johnson - Business Management Assistant

Monica Johnson accepted a transfer to the USDA Forest Service in 1999 and is assigned as Business Management Assistant to the Public Use & Facilities (PUF) and Acquisition Management (AM) staffs. Previous work assignments include the Navy Supply Center, Oakland; Navy Public Works Center, San Francisco Bay and Engineering Field Activity West, San Bruno.

Heidi Valetkevitch - Public Affairs Specialist

Heidi is assigned to the Forest Service's national headquarters in Washington, DC, where she serves as the national media officer in the Office of Communication. Heidi was detailed to the Sierra Nevada Framework Review Team and the Public Affairs and Communications Office as a communications coordinator.

Wendy Yun - Executive Assistant and Administrative Liaison

Wendy joined the ranks of the Forest Service in the summer of 1992. Before accepting her current position with the Sierra Nevada Framework for Conservation and Collaboration, she worked as a hydrologist on the Tahoe National Forest. She holds a Bachelor’s Degree in Biophysics from the University of California at Berkeley.

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Acronyms and Abbreviations

A.A.	Associate of Arts degree
ac.	Acre
ALSE	Area of Late Successional Emphasis
AM	Acquisitions Management
AMS	Aquatic Management Strategy
AOC	Area of Concern
APCD	Air Pollution Control District
ASQ	Allowable Sale Quantity
AUM	Animal Unit Month
BA	Basal area
B.A.	Bachelor of Arts degree
BACM	Best Available Control Measure
BAER	Burned Area Emergency Rehabilitation
BLM	Bureau of Land Management
BM	Benchmark
B.S.	Bachelor of Science degree
BVFSYU	Big Valley Federal Sustained-Yield Unit
CAR	Critical Aquatic Refuge
CARB	California Air Resource Board
CASPO	California spotted owl
CC	Canopy cover/closure
CCF	100 cubic feet
CDFG	California Department of Fish and Game
CEA	Cumulative effects analysis
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CI	Confidence interval
Co.	County
CRLF	California red-legged frog
CSU	California State University
CWD	Course woody debris
CWHR	California Wildlife Habitat Relationships system
DAU	Deer Assessment Unit
dbh	Diameter at breast height
DEIS	Draft environmental impact statement
DFC	Desired future condition
DFPZ	Defensible fuel profile zone
DFTM	Douglas-fir tussock moth
DSEIS	Draft supplemental environmental impact statement
EIS	Environmental impact statement
ESA	Endangered Species Act
FACA	Federal Advisory Committee Act
FARSITE	Fire Area Simulator (computer program)
FEIS	Final environmental impact statement
FEMAT	Forest Ecosystem Management Analysis Team
FERC	Federal Energy Regulatory Commission
FIA	Forest Inventory and Analysis
FLAMMAP	Fire Behavior Mapping and Analysis System (computer program)

FOFEM	First Order Fire Effects Model
FORPLAN	Forest Planning model (computer program) (See SPECTRUM)
FR	Federal Register
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSYU	Federal Sustained-Yield Unit (See BVFSYU)
ft.	Foot
FVS	Forest Vegetation Simulator (computer program)
FWS	Fish and Wildlife Service (See USFWS)
FY	Fiscal year
FYLF	Foothill yellow-legged frog
GAMMA	GAMMA Remote Sensing (computer program)
GC	Glucocorticoid
GIS	Geographic Information System
GRID	ArcInfo GRID
GS	Group selection
ha.	Hectare
HFQLG	Herger-Feinstein Quincy Library Group
HRCA	Home range core area
HIS	Habitat Suitability Index
ID	Interdisciplinary
IDT	Interdisciplinary team
km.	Kilometer
KMDA	Known Mineral Deposit Area
LOP	Limited operating period
LP	Linear programming
LSOG, LS/OG	Late Successional/Old Growth
m.	Meter
mi.	Mile
MIS	Management Indicator Species
mm.	Millimeter
MMBF	Millions of board feet
M.S.	Masters of Science degree
MOD 8	SNFPA FEIS Alternative Modified 8
MOU	Memorandum of Understanding
MYLF	Mountain yellow-legged frog
NAPA	National Academy of Public Administration
NEPA	National Environmental Policy Act
NF	National Forest
NFS	National Forest System
NLF	Northern leopard frog
NP	National Park
NPS	National Park Service
NRC	National Research Council
NRF	Nesting, roosting and foraging (habitat)
NRIS	Natural Resource Information System
NTMB	Neotropical migratory bird
OFEA, OFE	Old Forest Emphasis Area
OHV	Off-highway vehicle
OSV	Over the snow vehicle
PAC	Protected Activity Center
PCT	Pre-commercial thin
PFC	Proper functioning condition
PhD	Doctor of Philosophy degree
PM_{10}, $PM_{2.5}$	Particulates 10 microns in size and 2.5 microns in size

PROGNOSIS	Prognosis Simulator (computer program…See FVS)
PSW	Pacific Southwest Forest and Range Experiment Station
PUF	Public Uses and Facilities
RCA	Riparian Conservation Area
RCO	Riparian Conservation Objectives
RD	Ranger District
RDM	Residual dry matter
RNA	Research Natural Area\
RPA	Resource Planning Act
RO	Regional Office
ROD	Record of Decision
ROS	Rate of spread
RVD	Recreation Visitor Day
S&G	Standard and Guideline
SD	Standard deviation
SDI	Stand density index
SE	Standard error
SEIS	Supplemental environmental impact statement
SIA	Special Interest Area
SNEP	Sierra Nevada Ecosystem Project
SNFPA, SNFP	Sierra Nevada Forest Plan Amendment
SOHA	Spotted Owl Habitat Area
SPECTRUM	Spectrum model (computer program)
SPLAT	Strategically placed area treatment
spp.	Species
SSFCA	Southern Sierra Fisher Conservation Area
T&E	Threatened and Endangered
TEPS	Threatened, Endangered, Proposed or Sensitive
TES	Threatened, Endangered or Sensitive (See TEPS)
TMDL	Total maximum daily load
TMO	Timber Management Officer
TSPIRS	Timber Sale Program Information Reporting System
TWS	The Wildlife Society
UC	University of California
US	United States
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
UV-B	Ultraviolet-B
WHR	Wildlife Habitat Relationships (See CWHR)
WUI	Wildland Urban Intermix
yr.	Year

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