Chapter 4: Environmental Consequences

Table of Contents

Introduction 185
Science Consistency Review 185
4.1. Cumulative Effects 186
4.1.1. Background 186
4.1.2. Cumulative Effects of Other Plans, Policies, and Initiatives 187
4.1.3. Cumulative Effects for the Five Problems addressed in the FEIS 191
4.1.4. Cumulative Effects on Specific Management Programs 192
4.2. Physical and Biological Environment 194
4.2.1. Old Forest Ecosystems 194
4.2.2. Forest and Vegetation Health 199
4.2.3. Aquatic, Riparian, and Meadow Ecosystems 207
4.2.4. Fire and Fuels 215
4.2.5. Noxious Weeds 227
4.2.6. Air Quality 229
4.2.7. Soil Quality 232
4.3. Species of the Sierra Nevada 234
4.3.1. Threatened, Endangered, and Proposed Species 234
4.3.2. Forest Service Sensitive Species 241
4.3.3. Management Indicator Species 308
4.3.4. Neotropical Migratory Birds 313
4.3.5. Endangered, Threatened, Proposed, and Sensitive Plant Species 315
4.4. Land and Resource Uses 316
4.4.1. Commercial Forest Products 316
4.4.2. Grazing 322
4.4.3. Roads 324
4.4.4. Recreation 326
4.5. Environmental Consequences for Alternatives F2 through F8 328
Alternative F2: Establish large reserves where management activities are very limited 328
Alternative F3: Actively manage to restore ecosystems. Use local analysis and collaboration 328
Alternative F4: Develop ecosystems that are resilient to large-scale, severe disturbances 329
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 . 330
Alternative F6: Integrate desired conditions for old forest and hardwood ecosystems with fire and fuels management goals. Reintroduce fire into Sierra Nevada forest ecosystems 331
Alternative F7: Actively manage entire landscapes to establish and maintain a mosaic of forest conditions approximating patterns expected under natural conditions 332
Alternative F8: Manage sensitive wildlife habitat cautiously. Develop new information to reduce uncertainty about the effects of management on sensitive species 333
4.6. Other Effects 334
Unavoidable Adverse Effects 334
Relationship between Short-Term Uses and Long-Term Productivity 334
Irretrievable and Irreversible Commitment of Resources 334
Civil Rights and Environmental Justice 334

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

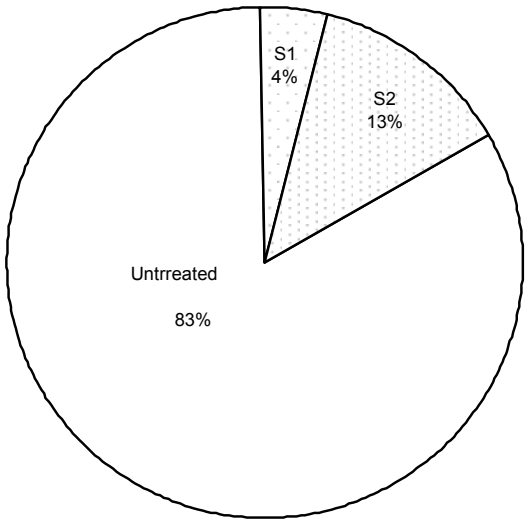
- implementation of vegetation management activities (thinning) intended to create vigorous and healthy growing conditions that are likely to reduce/prevent insect and diseased-related damage or mortality,
- implementation of direct suppression efforts against Jeffrey pine beetle,
- amount of green slash 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

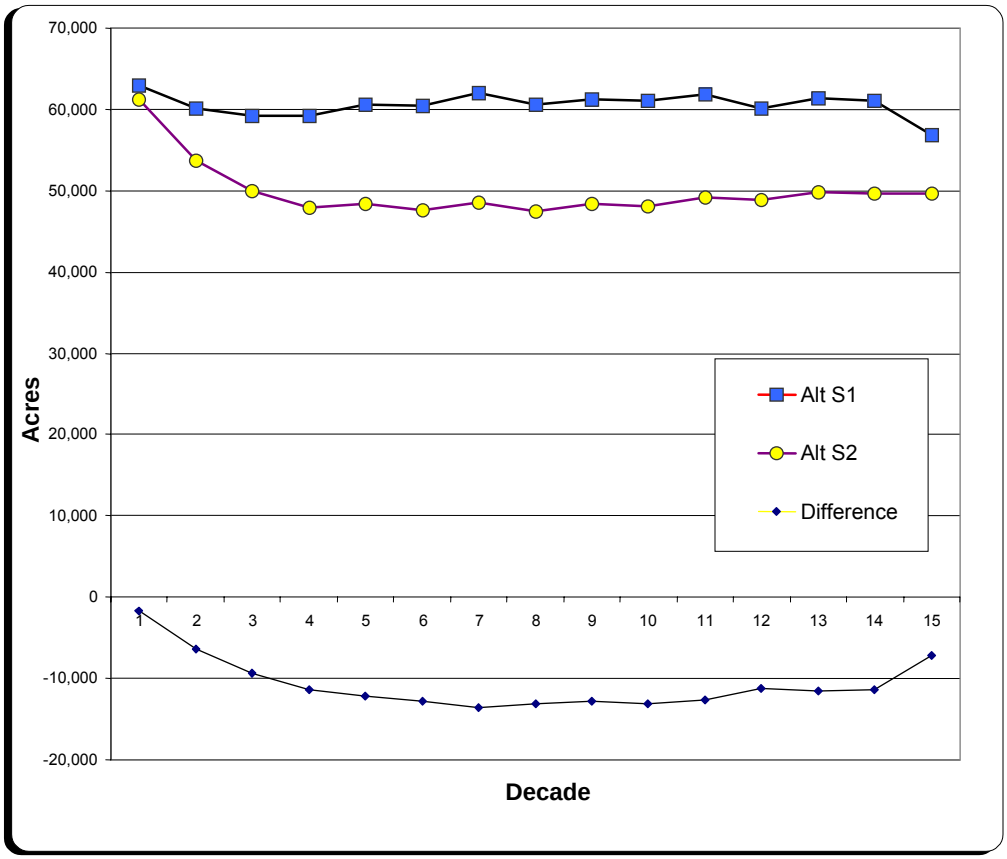
From 1910 through 1980, an average of 43,000 acres per year burned in wildland fires in the Sierra Nevada bioregion. This average, however, does not reflect the episodic nature of large fires.

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.



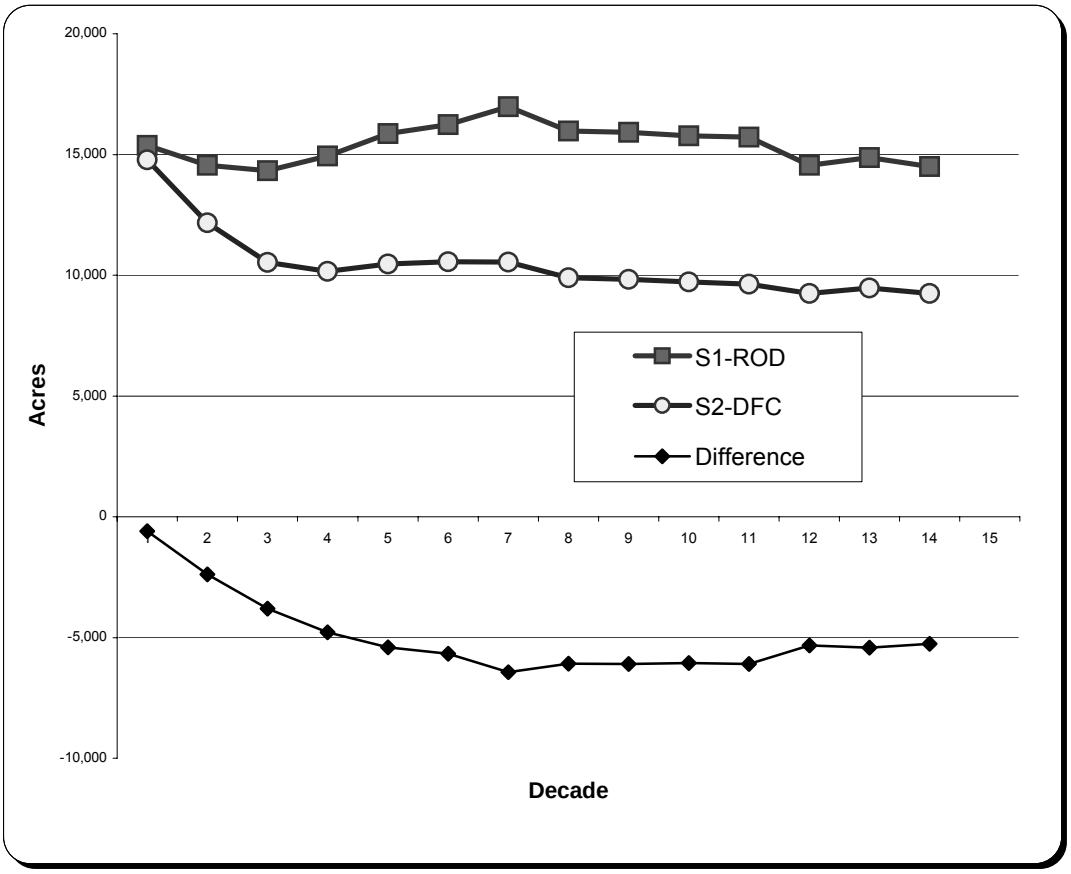
(Source: USDA Forest Service, Pacific Southwest Region 2003d)

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

INITIAL TREATMENTS ONLY	NET ACRES PLANNED FOR TREATMENT - NEXT 20-YEARS		
	S1-FSEIS Planned acres treated	S1-FSEIS Effected Acres	**S2-FSEIS**
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)		bv	
	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**

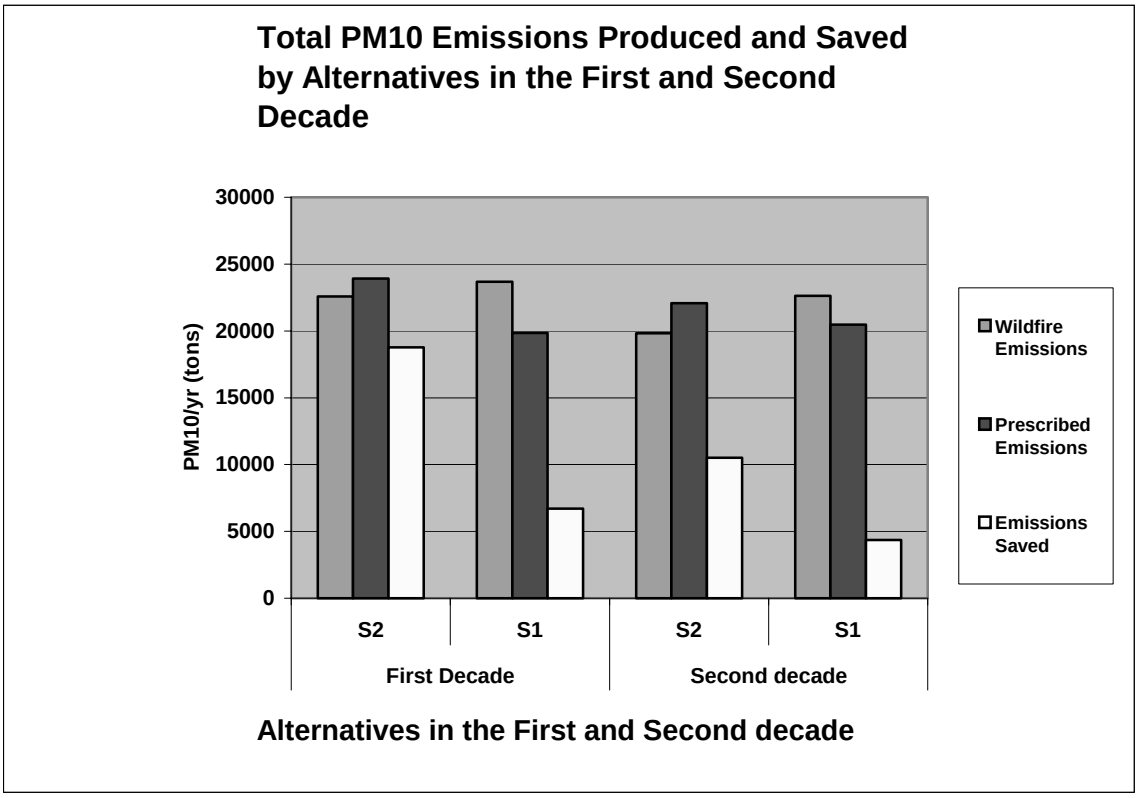
** Includes emissions from pile burns from mechanically treated acres. (Source: Ahuja 2003)*

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.

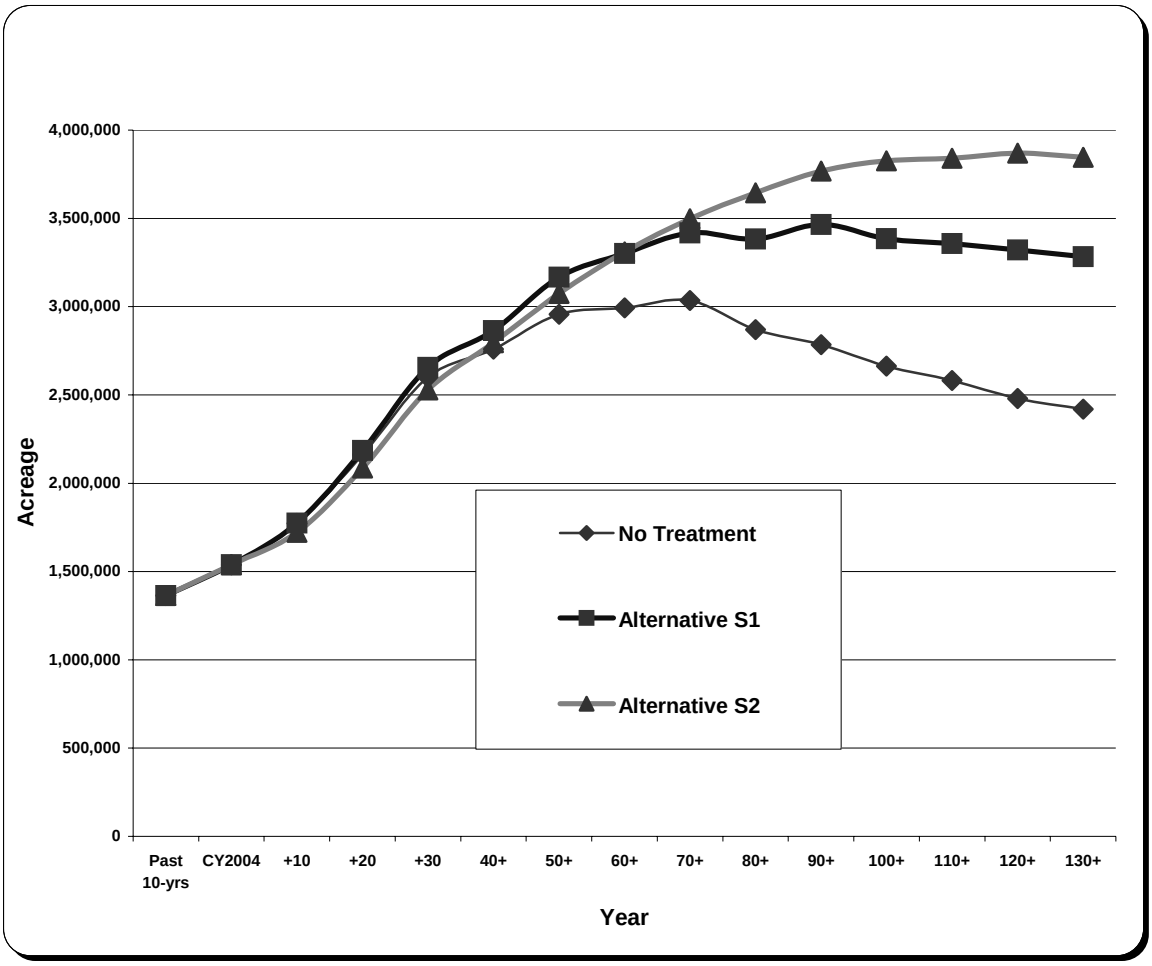
Quality and Quantity of Habitat

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.

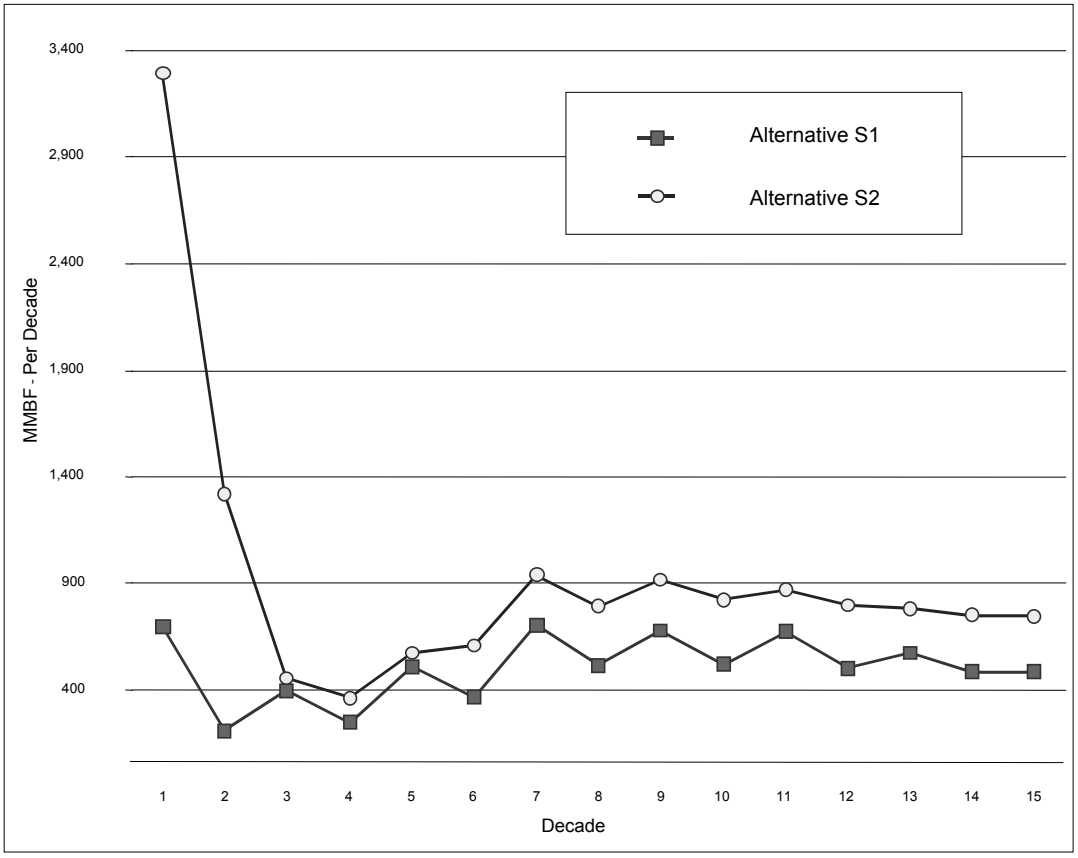
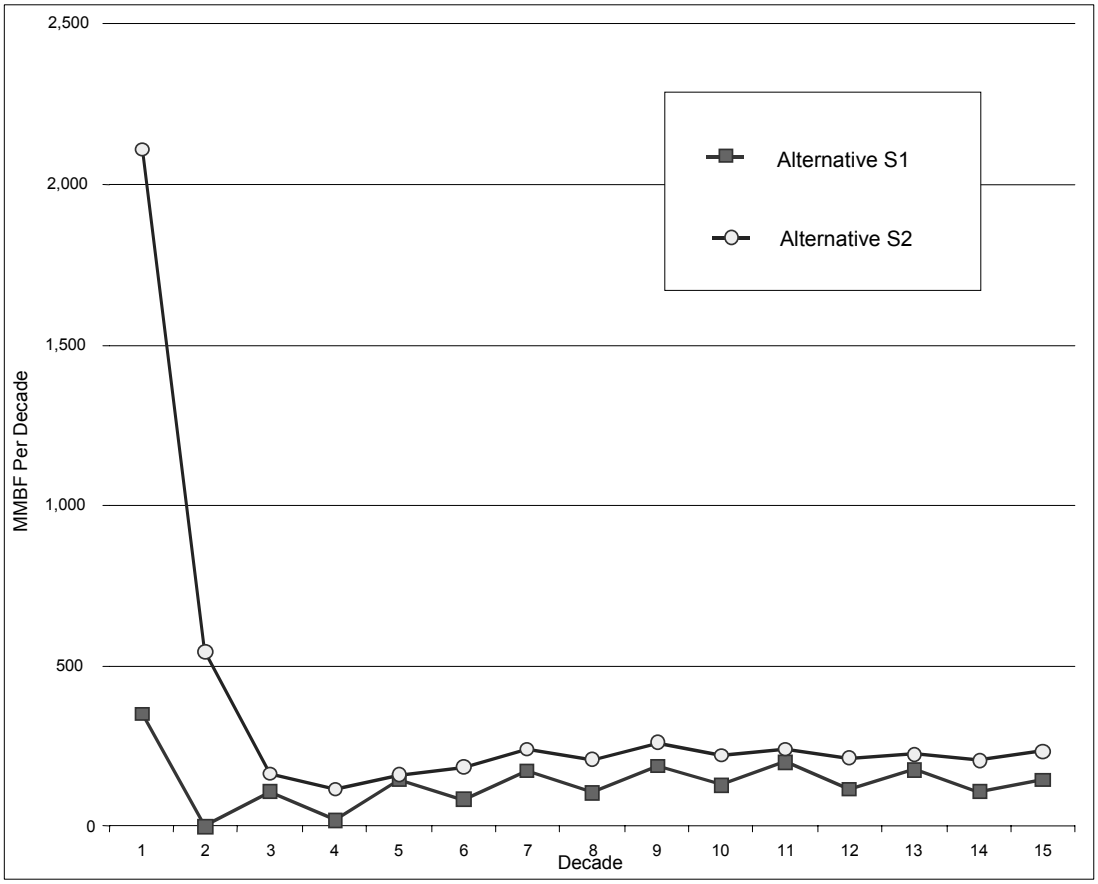


Figure 4.4.1b. Projected Decadal Green Sawtimber Harvest for the HFQLG Pilot Project Area.



(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.

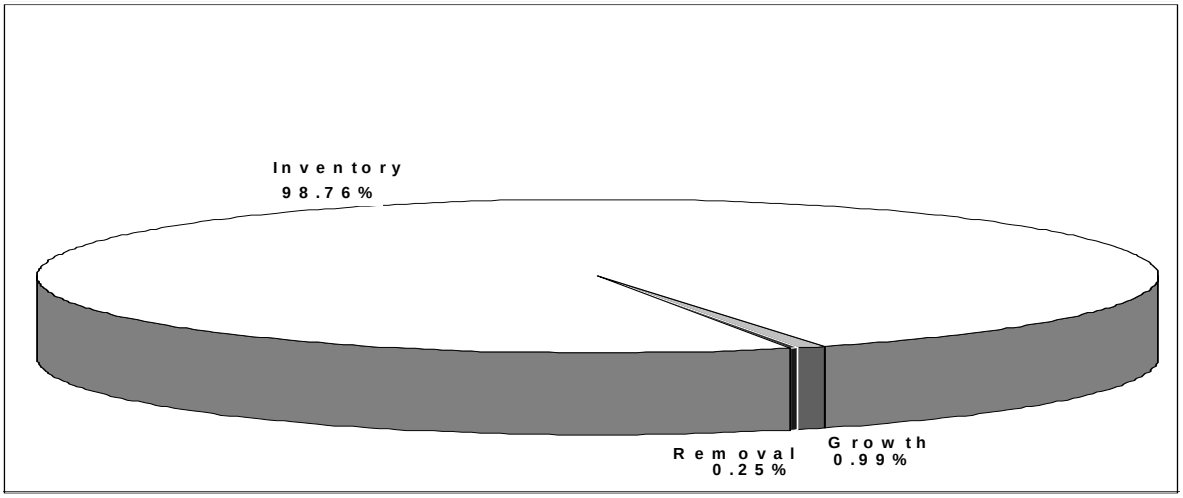
National Forest Unit	Alternative S1		Alternative S2	
	Decade 1	Decade 2	Decade 1	Decade 2
Sierraville Ranger District (HFQLG)	808	11	7,003	1,762
Tahoe National Forest, except Sierraville RD	4,090	18	16,867	12,646
Stanislaus National Forest	3,141	938	23,176	11,629
Giant Sequoia National Monument (GSNM)	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.

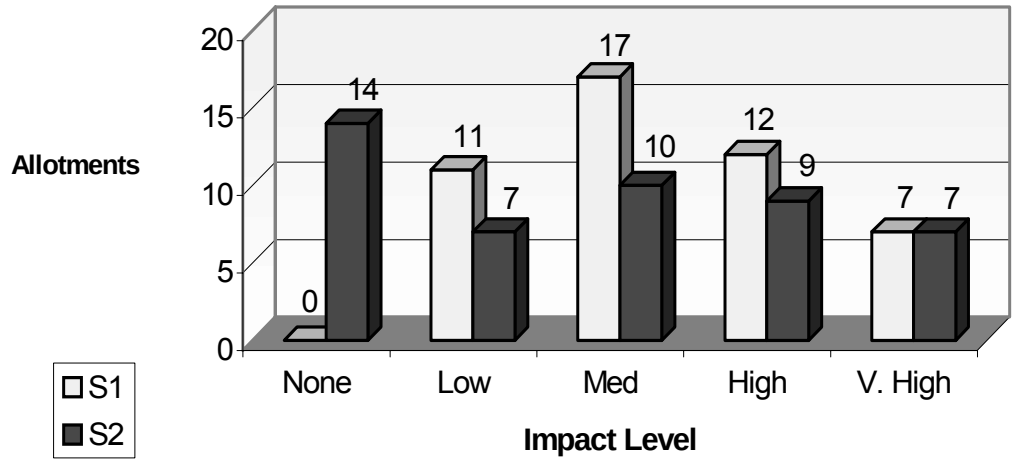
Assumptions

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.